UMTRA PROJECT

Uranium Mill Tailings Remedial Action Surface Project 1979 – 1999

End-of-Project Report

MAY 1999
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Uranium Mill Tailings Remedial Action Project

End-of-Project Report

U.S. Department of Energy
Environmental Restoration Division
Albuquerque, NM

MAY 1999

Prepared by
Jacobs Engineering Group, Inc.
Albuquerque, NM

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Introduction

The Department of Energy's (DOE) Uranium Mill Tailings Remedial Action (UMTRA) Project marked a significant milestone in September 1998 – the remediation of the last site as mandated by the Uranium Mill Tailings Radiation Control Act of 1978.

During the past two decades, the UMTRA Project team member's record of success has established the project as a model for the rest of the Department. These successes were in the areas of technology development and innovation, stakeholder involvement in decision-making, construction safety, cost reduction and productivity improvement, and process management.

The purpose of this *UMTRA End-of-Project Report* is to review the background and history of DOE's oldest surface cleanup project, and to report what was accomplished in cleaning up the 22 abandoned uranium processing sites designated under the project.

Background and Need

Uranium mill tailings are the sandy waste produced by the uranium ore milling process. Because only one to five pounds of usable uranium is extracted from each ton of ore, large quantities of waste were produced during the more than 40 years of U.S. milling operations. These tailings contained many naturally occurring hazardous substances, both radioactive and non-radioactive, and include 85 percent of the radioactivity found in the unprocessed uranium ore. The greatest threat to public health and safety was presented by the radioactive decay process of this material into radium and radon-222, an inert gas, which may cause cancer or genetic mutations.

From the early 1940s through the early 1970s, uranium was being processed under federal contracts for the government's Manhattan Engineering District and Atomic Energy Commission programs. As the initial demand for uranium decreased in the late 1960s, mills started to shut down, leaving behind process waste tailings.

There was little official recognition of the hazards presented by these tailings. Federal regulation of the industry was minimal. As a consequence, mill tailing piles were left at sites in an unstabilized and unprotected condition. Some of these tailings were used in the construction of foundations and walls of private and public buildings. There, through the concentrated emission of radon gas, public exposure increased substantially.

In 1971, the Subcommittee on Raw Materials of the Joint Committee on Atomic Energy began to investigate the dangers presented by the use of uranium mill tailings for construction purposes. Testimony at those hearings led to the passage of legislation in 1972 authorizing the federal government to enter into a cooperative program with the State of Colorado to remove tailings from sites and structures in Grand Junction, CO, where they constituted a threat to public health. Under this program, 75 percent of the cost of remedial action was paid by the federal government and the state paid the remainder.

Concurrently, public and federal attention began to focus on the regulation of the active uranium milling industry. With passage of the National Environmental Policy Act, more scrutiny was applied to licensing standards and requirements for the control and disposal of uranium mill tailings. The U.S. Nuclear Regulatory Commission (NRC) has had authority for licensing uranium mills under the Atomic Energy Act since 1954.

In 1974, Congress directed the Energy Research and Development Administration to survey and assess the problem presented by the tailings located at 22 inactive sites throughout the United States. On the basis of the resulting studies, the Carter Administration proposed legislation in 1978 to authorize a remedial program similar to that implemented in Grand Junction to clean up existing inactive sites.

UMTRA Legislation

The UMTRA Project was established with enactment of the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978 (Public Law 95-604, November 8, 1978, 92 Stat. 3021; 42 USC § 7901 *et seq.*). This law established a seven-year completion deadline for the cleanup of 22 designated sites. UMTRCA authorized the Secretary of Energy to designate additional mill tailings sites for remediation. This resulted in two more sites being added for a total of 24 designated sites. In 1997, the Secretary removed two of the designated sites.

The law specified that the U.S. Environmental Protection Agency (EPA) would establish the standards to be used during remedial action. Standards were published on March 7, 1983. The NRC was directed to provide consultation and concurrence in the type of remedial action that would be performed. DOE was directed to comply with the National Environmental Policy Act and perform detailed studies of the environmental impacts that remedial action would have at each site before remedial action began.

DOE was responsible for cleanup of the 24 designated former uranium sites as well as the properties in the vicinity of the sites where wind and water erosion deposited tailings or where people removed them from the site for use in construction or landscaping. Cleanup was to be undertaken in cooperation with state governments and Indian tribes within whose boundaries the sites were located.

The U.S. Government and affected states were directed to share the construction cost of UMTRA cleanup efforts; the federal government paid 90 percent and the states involved paid the remaining 10 percent. Where cleanup occurred on Indian lands, the federal government paid 100 percent of the cost.

UMTRCA Amendments

UMTRCA was amended in 1983 (Public Law 97-415, Sec. 21, January 4, 1983, 96 Stat. 2079) to add Edgemont, S.D., vicinity properties.

On September 23, 1988, Congress passed the UMTRA Amendments Act of 1988 (Public Law 100-616, November 5, 1988, 102 Stat. 3192) extending DOE's surface cleanup authority to September 30, 1994. The law placed no limitation on groundwater restoration authority.

On October 24, 1994, UMTRCA Title I authority was extended by Congress (Public Law 102-486, Sec. 1031, October 24, 1994). This law moved the project completion date from September 30, 1994, to September 30, 1996.

Public Law 104-259 was signed on October 9, 1996, extending UMTRCA Title I authority to September 30, 1998.

Project Accomplishments

Surface project highlights include:

- 22 sites completed
- 5,335 vicinity properties cleaned up
- 18 disposal cells licensed by the NRC
- 43.8 million cubic yards (33.5 million cubic meters) of material stabilized
- 22.2 million (35.8 million kilometers) truck miles driven without a fatality
- Injury rate 85 percent below national construction rate
- DOE Quality Team Award received in 1994
- National Performance Review "Hammer Award" received in 1995
- $75.4 million saved through the Cost Reduction/Productivity Improvement Program
- Estimated 1,300 cancer deaths avoided from reduced radon and radiation exposure over next 100 years

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UMTRA History

As the UMTRA surface project celebrates completion this year, team members can look back with pride on 20 years of award-winning remediation work. The dedication and hard work of untold thousands of workers have made UMTRA the DOE's oldest and most successful environmental restoration project.

This aerial view (circa 1956) of the uranium mill site at Grand Junction, CO, is typical of the 22 sites cleaned up by the UMTRA Project.

The Beginnings

In 1972, a Congressional subcommittee conducted hearings to look at a possible cleanup program for Salt Lake City, UT. As a result of those hearings, the committee authorized a comprehensive study of all potential cleanup sites.

Preliminary engineering evaluations of the sites were conducted during 1975. By 1977, the conclusion had been reached that a cleanup program was needed to alleviate potential health hazards from the former processing sites.

DOE proposed legislation to Congress that would establish the UMTRA Project. Hearings were held in the House and Senate, with Congress passing the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978 in November of that year.

The law established a seven-year completion deadline for the project and outlined the funding formula for the cleanup. Participating states were responsible for 10 percent of the cost of remedial action, with the federal government paying the remaining 90 percent. The federal government was responsible for 100 percent of the cost for those sites located on tribal land. UMTRCA also required that DOE keep site community stakeholders informed of UMTRA Project plans and activities.

Twenty-two processing sites were named in the legislation for cleanup. These included Canonsburg, PA; Salt Lake City, Green River and Mexican Hat, UT; Durango, Gunnison, Grand Junction, Rifle (two sites), Naturita, Slick Rock (two sites) and Maybell, CO; and Riverton and Spook, WY.

Other sites among the 22 were Lakeview, OR; Shiprock and Ambrosia Lake, NM; Falls City, TX; Tuba City and Monument Valley, AZ and Lowman, ID.

Belfield and Bowman, ND were nominated for designation, as was Baggs, WY. Baggs was subsequently dropped. Burrell, PA, a major vicinity property associated with Canonsburg activities, saw cleanup resulting in development of a disposal site.

DOE Gets Organized

In early 1979, one of the first steps taken at DOE headquarters was to transfer responsibility for cleanup of the mill tailings sites from its environmental organization to its nuclear energy organization. The next steps were to establish a formal project, form a project office within DOE's Albuquerque Operations Office, appoint a project manager and hire contractors to provide the expertise to actually conduct project operations.

Contractor Selection

DOE decided in 1979 on two prime contractors - a remedial action contractor (RAC) and a technical assistance contractor (TAC) – as part of the acquisition strategy before setting up the UMTRA Project Office. The concept was designed to allow for a checks and balances approach, particularly in the areas of design, cost and schedule. Sandia National Laboratories served as the interim

TAC until the formal selection process was completed.

The TAC was responsible for site characterization, the National Environmental Policy Act process, conceptual site design, final design reviews, health and safety programs, quality assurance, public information and participation, and assisted DOE with cost and schedule control.

Jacobs Engineering Group Inc., teamed with Roy F. Weston, Inc., and Sergent, Hauskins and Beckwith (now AGRA Earth and Environmental), was awarded the technical assistance contract in March 1982. Geraghty & Miller, Inc., joined the TAC as a subcontractor in 1991.

The RAC's responsibilities included detailed design and engineering for remedial action; remedial action construction and inspection; and on-site health, safety, radiation and environmental monitoring.

In March 1983, MK-Ferguson Company was awarded the remedial action contract. MK-Ferguson used competitively awarded, fixed unit price construction subcontracts for all sites except Salt Lake City, which was remediated by the State of Utah, and the vicinity property (VP) cleanup in Grand Junction, CO.

DOE's Grand Junction Projects Office (renamed the Grand Junction Office in 1996) managed the large VP cleanups in Grand Junction, CO and Edgemont, SD through its contractor, Bendix Field Engineering Corp. Chem-Nuclear Geotech (later RUST Geotech) replaced Bendix, and MACTEC Environmental Restoration Services replaced RUST in August 1996. Another UMTRA Project contractor, the Oak Ridge National Laboratory, performed VP inclusion surveys and independent VP cleanup verification.

Technology Development

In early 1980, the UMTRA Project initiated a comprehensive technology development program. This program continued some work begun in previous years under other DOE sponsorship and added new tasks to cover previously unexplored facets of the tailings disposal problem.

Five areas of technology were identified and included cover technology, liner technology, measurements and monitoring, tailings conditioning, and basic studies. These research programs continued through fiscal year 1984 and provided substantial knowledge of the potential for groundwater contamination, performance of radon barriers, and the optimum design for disposal cell covers.

First Cooperative Agreement

A cooperative agreement was executed between DOE and the Commonwealth of Pennsylvania during 1980. This was the first of such agreements between the Department and the affected states and Indian tribes for each UMTRA site.

With the cooperative agreements, the parties defined the roles and responsibilities of the DOE, the states, and tribes involved. The DOE and the NRC signed all the agreements and the states, tribal leaders, and the Bureau of Indian Affairs signed the agreements for their respective site.

EPA Establishes Standards

UMTRCA specified that the EPA would establish the standards to be used during the remedial action. EPA standards for the UMTRA Project were submitted to the Office of Management and Budget in September 1982. Formal publication of these standards on March 7,1983, cleared the way for DOE to begin remedial action at the designated processing sites. It also started the clock for the seven-year period authorized for completion of the project. DOE's authority to perform remedial action was set to expire on March 6, 1990.

The U.S. Court of Appeals for the 10th Circuit remanded the groundwater provisions of the standards in September 1985. EPA published its proposed replacement provisions in September 1987. Final standards were published in 1995.

Design Framework

Following the National Environmental Policy Act process, disposal cells were designed using the Project's "Technical Approach Document," a DOE/NRC approved design-based standard. The NRC and appropriate state/tribal agencies then approved the remedial action plans for cleanup of processing sites and construction of disposal cells.

Remediation Begins

Remedial action began at the first UMTRA site – Canonsburg, PA – on October 7, 1983. In addition, 52 VPs were cleaned up during the year in Salt Lake City, UT, Canonsburg, PA, and Grand Junction, CO. Also that year, the Oak Ridge National Laboratory was designated the UMTRA Project inclusion survey contractor and opened a field office in Grand Junction to provide easier access to western state VPs.

During 1984, DOE identifed 8,156 potential vicinity properties for inclusion in the UMTRA Project. This action, completed in compliance with a consent order filed in U.S. District Court, identified all known potential VPs as of February 2, 1984.

Vicinity property remediation work continued to pick up pace during 1984 with 118 new construction starts at four different locations, and 69 completions. The numbers increased to 319 new starts and 161 completions during 1985. This work continued to accelerate as the project prepared for the upcoming peak engineering and construction years.

Remedial actions began at the Shiprock, NM site in October 1984, the Tuba City, AZ site (Phase I – which included the demolition of buildings and site preparation activities) in January 1985, and the Salt Lake City, UT site in February. Cleanup work at Canonsburg, PA was completed in December 1985. During 1986, two sites were started, and one was completed. Remediation started at the Lakeview, OR site in June and at the Durango, CO site in October. Cleanup work at the Shiprock, NM site was completed in October.

Phase I remediation was completed at the Tuba City, AZ site in February, 1986. Phase I cleanup of the Mexican Hat, UT site was also started in July 1987 and completed that October. The project also initiated Phase I remediation of the Ambrosia Lake, NM site in July 1987.

Scrap metal (upper right photo), brick uranium roasters (lower right) and mill towers (below) were found at many of the sites. All required removal as part of the cleanup process.

UMTRCA Extended

On September 23, 1988, Congress passed the UMTRA Amendments Act of 1988. This legislation extended DOE's cleanup authority by more than four years to September 30, 1994. In extending UMTRCA, Congress recognized that:

- EPA standards were more stringent than expected,
- the project was more complex to administer than expected,
- budget constraints made it impractical for DOE to seek or obtain the large annual appropriations required to complete remediation within the original authorization period and
- the states needed more time to appropriate their 10 percent cost share.

The Act also permitted groundwater compliance without time constraint "...given the uncertainties surrounding the groundwater restoration problem."

During 1988, the UMTRA Project started cleanup of six additional sites: Tuba City, AZ (Phase II) in January; Riverton, WY in March; the two sites at Rifle, CO (Phase I), in September; Green River, UT in November; and Grand Junction, CO (Phase I) in December.

Dirt removal (above) was a large task at the sites as contamination from the mill tailings was prevalant. Another necessary disposal site task was producing bentonite amended clay for use as a radon barrier.

1989 marked the beginning of remediation at three UMTRA sites and the completion of four others. Start-up sites included Spook, WY in April; Monument Valley, AZ in May; and Grand Junction, CO (Phase II) in December. Completed sites were Salt Lake City, UT in June, Spook, WY in September, Lakeview, OR in October and Green River, UT in December. In addition, Phase I cleanup of the Ambrosia Lake, NM site was complete in April and Phase I of the two Rifle, CO sites in September.

Funding Delays

In February 1990, funding restrictions forced DOE to suspend remediation activities at the Monument Valley, AZ site as well as at nearby Mexican Hat, UT. Construction subcontracts were terminated by MK-Ferguson at both locations.

Cleanup work was completed at two other sites during 1990. Tuba City, AZ was finished in April and Riverton, WY was completed in September.

Groundwater Project Begins

The groundwater restoration phase of the UMTRA Project began on April 1, 1991. This effort started with definition of the planning documents needed to carry out groundwater restoration at uranium mill sites.

1991 also marked the start of surface remediation at the Lowman, ID site in April and the beginning of Phase I cleanup at the Gunnison, CO site in September. Remediation was completed at the Durango, CO site in May.

The UMTRA Project received its first processing site certification from the NRC during May 1991. NRC

concurred with DOE's certification that the Shiprock, NM site was complete and in compliance with EPA standards.

1992 was a busy year for the project with cleanup activity starting at five sites, restarting at two others and finishing up at one. Start-ups included the Falls City, TX site in January; the two sites at Rifle, CO (Phase II), in April; the Gunnison, CO site in June; and the Ambrosia Lake, NM site (Phase II) in October.

Remediation efforts were restarted at Mexican Hat, UT (Phase II), and Monument Valley, AZ in September, and cleanup efforts were completed at Lowman, ID in June.

On October 24, 1992, Congress passed a bill to once again extend UMTRCA from September 30, 1994, to September 30, 1996. This provided two of the four additional years DOE had requested to complete the surface phase of the project.

NRC Licenses First Site

In September 1993, Spook, WY became the first UMTRA site licensed by the NRC. The disposal cell was brought under the Commission's general license for UMTRA Project sites after acceptance of the Spook long-term surveillance plan. Remediation activities continued at seven site during 1993.

1994 was another busy year for the UMTRA surface project with one new site start and three completions. Phase I remediation started at Naturita, CO in May with demolition of structures at the former processing site. This work was completed in November. Cleanup of the mill site at Monument Valley, AZ was completed in March with the relocation radioactive material to the nearby Mexican Hat disposal cell at Halchita, UT. Remediation was also completed at the Falls City, TX site in June and at the Grand Junction, CO processing site in August. The Grand Junction disposal cell at Cheney Reservoir remains open to accept radioactive material from ongoing VP remediation efforts.

In 1994, the NRC licensed Burrell, PA in May and Lowman, ID in September.

CR/PIP Earns Awards

The UMTRA Project was singled out for national recognition of its Cost Reduction/Productivity Improvement Program during 1994.

In October, Secretary of Energy Hazel O'Leary presented the DOE Quality Team Award to the Project during ceremonies in Washington. This award recognized the UMTRA team's cost savings and avoidances of nearly $60 million between 1988 and 1994.

The UMTRA Project was a recipient

At the helm

A number of skilled managers have led the DOE project office, TAC and RAC since the UMTRA Project opened its offices in Albuquerque in 1979. These leaders were:

DOE Project Office

1979 – Richard Campbell
1983 – James Morley
1985 – John Themelis
1987 – James Anderson
1988 – W. John Arthur III
1989 – Mark Matthews
1992 – Al Chernoff
1994 – Chuck Cormier
1995 – Rich Sena
1997 – George Rael

TAC

1982 – Krish Krishnan
1985 – Roger Williams
1986 – Don Dubois
1989 – Steve Hill
1991 – Ned Larson
1992 – Roger Nelson
1995 – Larry Pinkel

RAC

1983 – Pete Miller
1984 – Russell Hopkins
1986 – Jim Oldham
1992 – Bob Lawrence
1997 – Rob Cooney

of Vice President Al Gore's National Performance Review Hammer Award in September 1995, marking the Project's outstanding cost savings record and efforts to streamline and reinvent government.

The Project saw remediation start at three sites during 1995 and the completion of three others. Cleanup began at the two Slick Rock, CO sites in March and at the Maybell, CO site in May.

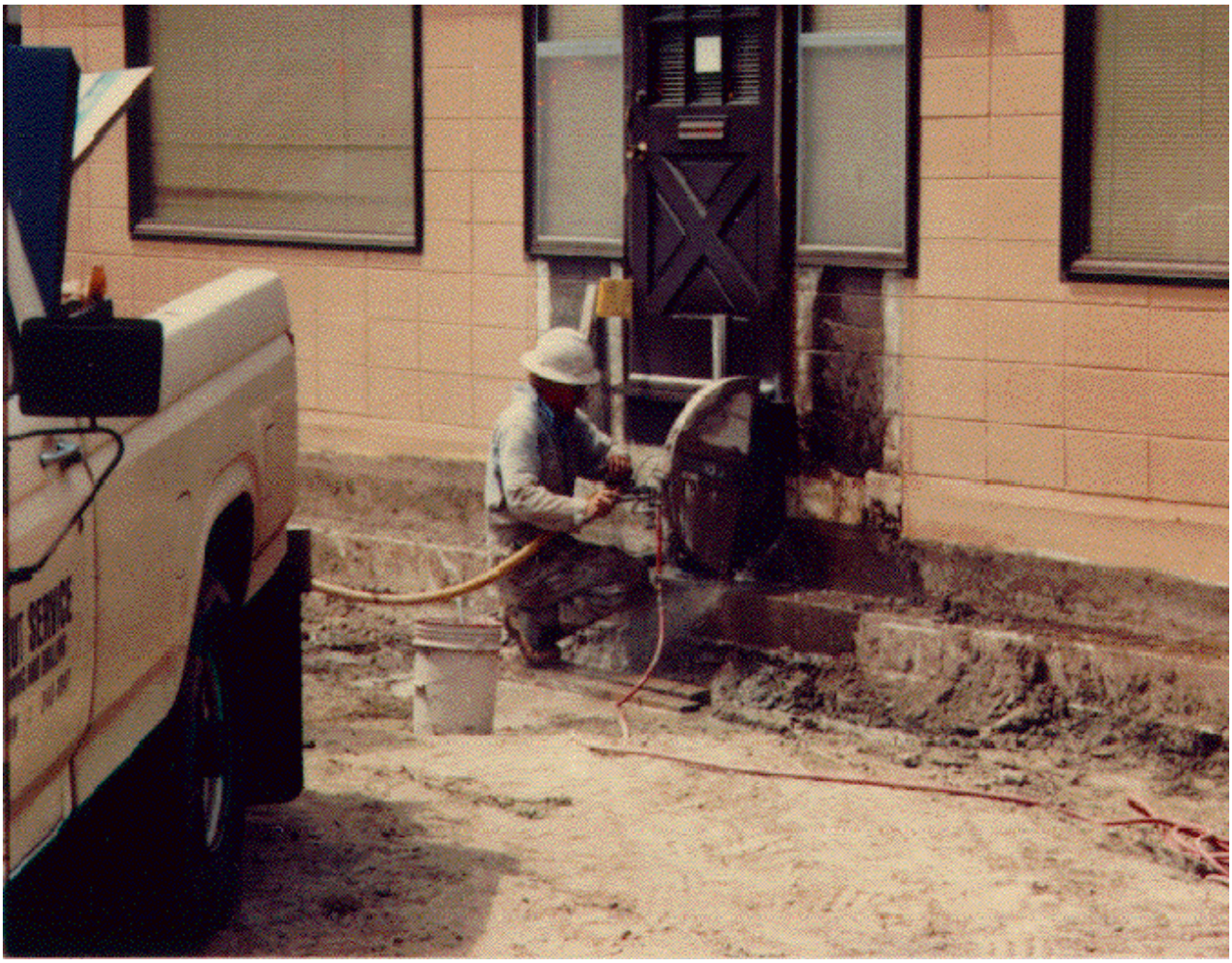
Work was completed at Mexican Hat, UT in February, at Ambrosia Lake, NM in July and at Gunnison, CO in December. The disposal site at Lakeview, OR was licensed by the NRC during September 1995. On October 18, DOE celebrated the successful cleanup of the 4,000th vicinity property in Grand Junction, CO.

On January 11, 1995, the EPA published its final standards for groundwater cleanup in the *Federal Register.* In developing the final standards, EPA used detailed information provided by DOE for 17 of the 24 sites covered under Title I of UMTRCA.

During 1996, the UMTRA Project completed four sites and started its last site cleanup effort. Phase II remediation was completed at the two Rifle, CO sites in October and at the two Slick Rock, CO sites in December. Phase II cleanup work began at the last UMTRA site, Naturita, CO, in June.

The NRC licensed four disposal sites during 1996: Canonsburg, PA in January; Shiprock, NM and Durango, CO in September; and Tuba City, AZ in November.

On October 9, 1996, President Clinton signed a bill which once again amended the UMTRCA, extending the authority of the Secretary of Energy to conduct remedial action until September 30, 1998.



This is an example of a Vicinity Property (VP) site cleanup. The foundation of this building had to be replaced because of the contamination found in the foundation walls.

Stakeholders were involved in project decision-making all during the cleanup process. Several public meetings to determine the site for the Naturita, CO, disposal cell, were held in the Naturita Community Center.

The law also authorized operation of the Cheney disposal cell near Grand Junction, CO for the receipt and disposal of residual radioactive material from processing sites , and of byproduct material from property in the vicinity of the uranium milling site at Monticello, UT until the cell is filled or September 30, 2023, whichever comes first.

During May 1997, the UMTRA Project sponsored a Lessons Learned Workshop as a forum for exchanging technical and management lessons learned during the project. Some 100 people attended the two-day workshop, which was held in Albuquerque.

As published in the *Federal Register* , the Secretary of the Department of Energy removed the Belfield and Bowman, ND as designated sites. This action was taken at the request of the State of North Dakota because of minimal public support, limited state funding and the very small risk to the public and the environment. This reduced the number of designated UMTRA sites from 24 to 22.

The NRC licensed four sites during 1997, bringing the total licensed to 11. These were Falls City, TX in July; and Gunnison, CO, Mexican Hat, UT, and Salt Lake City, UT in September. In addition, the NRC certified the processing sites at Grand Junction, CO and Monument Valley, AZ during the year.

In April 1998, DOE transferred responsibility for its Cheney disposal site near Grand Junction, CO from its Albuquerque Operations Office to its Grand Junction Office.

The NRC licensed four sites during 1998, bringing the total licensed to 15. These included Rifle, CO in January; Green River, UT and Slick Rock, CO in August; and Ambrosia Lake, NM in September.

On August 26, 1998, DOE celebrated the successful completion of the UMTRA surface project with an End-of-Project Celebration in Grand Junction, CO. More than 120 local, state, tribal and federal officials; current and former project members; and stakeholders attended.

The two remaining UMTRA sites were completed during 1998. Work on the Naturita and Maybell, CO sites was completed during the month of September. This brought the number of completed sites to 22. The NRC should license these two sites in June 1999.

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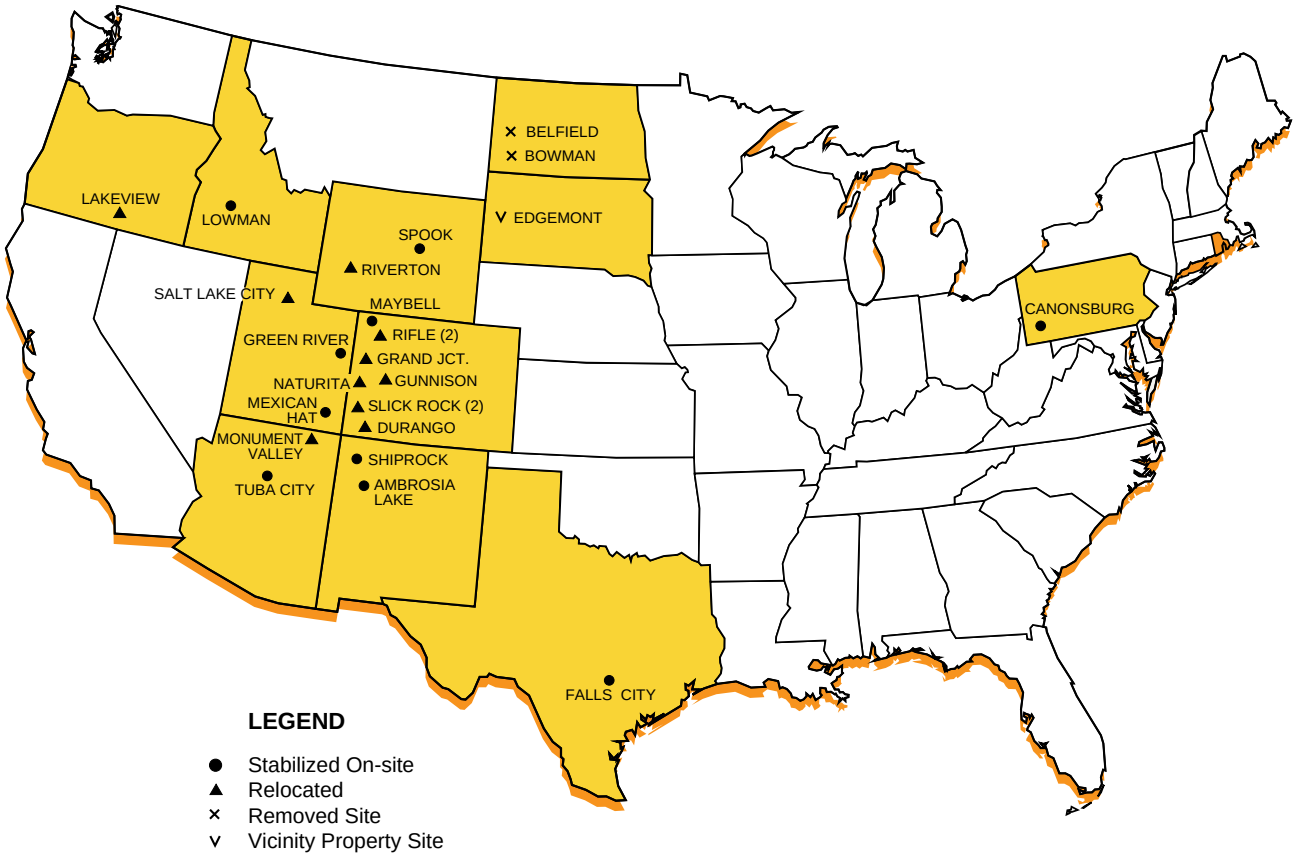
Site Information



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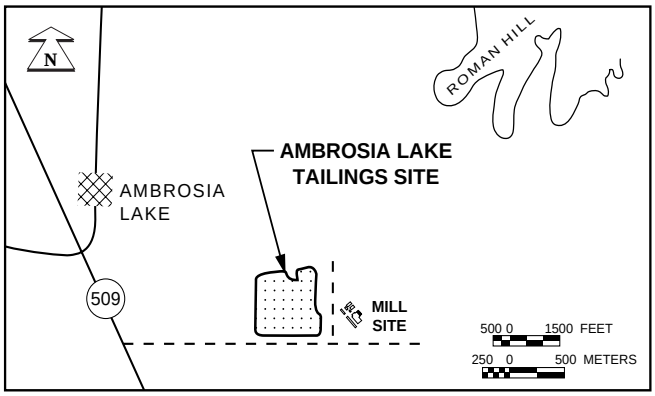
Ambrosia Lake, New Mexico

Site Description

The former Ambrosia Lake mill and tailings site is located in McKinley County in northwest New Mexico approximately 25 miles (40 kilometers) north of Grants and 85 miles (137 kilometers) northwest of Albuquerque. The tailings pile of residual radioactive material (RRM) covered approximately 105 acres (42 hectares); wind action and water erosion spread some of the tailings across an additional 570-acre (230 hectares) area.



Site History

Phillips Petroleum Company built the mill at the Ambrosia Lake, NM site in 1957 and operated it from June 1958 until March 1963 using uranium ore from nearby mines. The Phillips Mill used alkaline pressure leach technology to extract uranium from the ore. Uranium leaching occurred in tanks. Drum filters separated uranium from solution and waste was pumped to a nearby tailings pile. Following purchase of the mill by United Nuclear Corporation (UNC), all operations were scaled back and milling ceased in April 1963. UNC used portions of the mill as a resin ion exchange facility to extract uranium from mine water until 1982 when all site operations ceased.

Remedial Action

Phase I remedial action began in July 1987 and was completed in April 1989. It included construction of decontamination facilities, asbestos removal, demolition of the mill buildings and other site preparation activities.

Phase II remedial action began in October 1992 and involved excavating and consolidating RRM with the existing tailings, and stabilizing these materials. In 1993, the remedial action contractor buried all mill structure debris and folded the north half of the tailings pile over the south half.

Cleanup of the windblown material began in 1994. A protective cover of soil and rock was placed on top of the disposal cell to ensure compliance with EPA standards for longevity, control of radon emanation, and ground water protection.

The cleaned up areas surrounding the stabilized tailings pile were backfilled with clean soil, recontoured to promote surface drainage, and revegetated. Remedial action was completed in July 1995. The disposal cell was licensed by the NRC in September 1998 and deeded to the federal government for long-term surveillance and monitoring.

Site Information

The state acquired the site property in two tracts. The state acquired the surface estate of one tract from United Nuclear Corporation. The subsurface estate beneath this tract was divided into patented and unpatented mining claims. The unpatented claims were acquired from the Bureau of Land Management via a jurisdictional transfer on 12 March 1991. The three patented claims were purchased and conveyed from HELCA Mining Company via a warranty deed.

The state acquired the second tract to accommodate construction of a portion of the disposal cell. The state also acquired a permanent restrictive easement interest. The restrictive easement allows DOE to carry out the requirements of the long-term surveillance plan. Transfer from the state to the federal government took place September 22, 1998.

SCHEDULE MILESTONES

- (EA) FONSI: July 1987
- Final RAP: November 1991
- Date contractor mobilized: September 1992
- Date contractor demobilized: June 1995
- Date mill site certified: May 1997
- Date disposal cell licensed: September 1998

CELL STATISTICS

- Method of containment: Stabilize in place

- Volume of contaminated material handled: 3,569,882 cubic yards (2,731,356 cubic meters)
- Volume of contaminated material in cell: 6,045,882 cubic yards (4,625,770 cubic meters)
- Volume of uncontaminated material (fill) handled: 868,738 cubic yards (664,681 cubic meters)
- Average tailings radioactivity: 571 pCi/g, Ra-226
- Total radioactivity in cell: 1,850 Curies, Ra-226
- Cell dimensions: The disposal cell is located on gently sloping land and is rectangular in shape. It rises some 50 feet (15 meters) above the surrounding terrain and is approximately 2,500 feet (760 meters) long by 1,600 feet (490 meters) wide. It is approximately 65 feet (20 meters) deep from its highest to its lowest point.
- Cell design: Consolidation and stabilization on site of the contaminated subsoil, mill buildings, demolition debris, windblown contamination, and tailings. The disposal cell has a 3.5 to 4-foot (1.1 to 1.2 meters)-thick multilayered cover. A 2.5-foot (0.8 meter)-thick radon/infiltration barrier was placed over the contaminated materials. A 6-inch (0.15 meter) bedding layer was then placed to prevent damage to the barrier by the erosion protection layer

The mill site at Ambrosia Lake prior to clean up by the DOE.

Ambrosia Lake mill site with disposal cell following remediation.

rock and loss of the fine grained radon barrier material. Finally, an erosion protection layer was placed, consisting of six inches (0.15 meter) of rock (Type A riprap) on the topslopes and 12 inches (0.3 meter) of rock (Type B riprap) on the sideslopes. The maximum grade is four percent on the topslopes and 20 percent on the sideslopes.

CONSTRUCTION STATISTICS

- Truck miles driven: 33,111 (53,405 kilometers)
- Estimated risk reduction: 0.086 deaths prevented
- Peak employment level: 70
- Safety record:
  - Total Recordable Rate - 9.9
  - Total Lost Workdays Rate - 3.6
- Remediation subcontractor: Gibbons and Reed Co.
- Contaminated Material:
  - Equipment & method: Scrapers
  - Haul distance: Less than one mile (1.6 kilometers)
- Cover Material:
  - Radon barrier
    - Source: Borrow area north of site
    - Type material: Sandy clay
    - Haul distance: One mile (1.6 kilometers)
    - Equipment & method: Scrapers
    - Quantity: 341,032 cubic yards (206,927 cubic meters)
    - Bentonite %: None
  - Frost barrier (included as part of 2.5 feet [0.76 meters] radon barrier design)
- Erosion Protection:
  - Bedding
    - Source: Homestake Mining Co. quarry
    - Type material: Basalt
    - Haul distance: Approximately 17 miles (27 kilometers)
    - Quantity: 69,426 cubic yards (53,119 cubic meters)
    - Gradation: 3 inches (7.6 centimeters) x #30
  - Type A
    - Source: Homestake Mining Co. quarry
    - Type material: Basalt
    - Haul distance: Approximately 17 miles (27 kilometers)
    - Quantity: 45,652 cubic yards (34,929 cubic meters)
    - Gradation: 4 inches (10.2 centimeters) x 1/2 inch (1.3 centimeters)
  - Type B
    - Source: Homestake Mining Co. quarry
    - Type material: Basalt
    - Haul distance: Approximately 17 miles (27 kilometers)
    - Quantity: 48,430 cubic yards (37,054 cubic meters)
    - Gradation: 7 inches (17.8 centimeters) x 1/2 inch (1.3 centimeters)
  - Type C
    - Source: Homestake Mining Co. quarry
    - Type material: Basalt
    - Haul distance: Approximately 17 miles (27 kilometers)
    - Quantity: 30,948 cubic yards (23,679 cubic meters)
    - Gradation: 18 inches (45.7 centimeters) x 4 inches (10.2 centimeters)

OTHER INFORMATION

- Vicinity properties cleaned up: 5
- VP material volume: 1,529,081 cubic yards (1,169,917 cubic meters)
- Citizen Advisory Committee: None
- Public participation issues: None

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	1,706
Env. Health & Safety/NEPA	1,009
RA Design	3,178
Site Acquisition	422
RA Field Management	8,091
Site Preparation	4,165
Tailings Handling	6,011
Cover	1,364
Erosion Protection	3,776
Site Restoration	1,139
VP Design	36
VP Construction	15
All Other Construction Costs	2,757
Surveillance & Maintenance	118
Site Specific Total	$33,787

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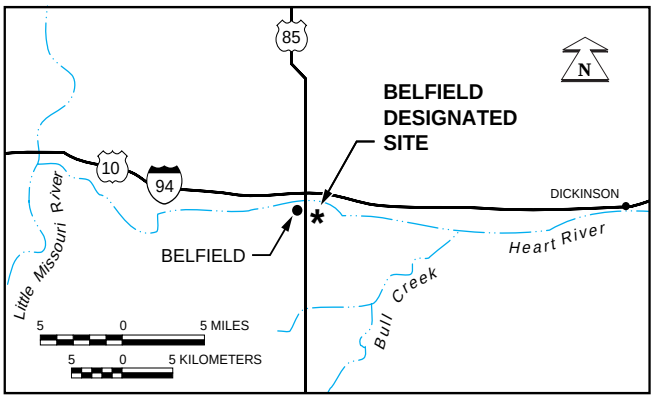
Belfield, North Dakota

Site Description

The Belfield site is located in southwestern North Dakota, one mile (1.6 kilometers) southeast of the town of Belfield in Stark County. The former ashing site occupies 10.7 acres (4.3 hectares) with no discernible pile remaining.

The ash, produced from lignite coal burned in a rotary kiln, contains uranium and radium. It was shipped to Rifle, CO and Ambrosia Lake, NM for further processing. Windblown stack-released ash has contaminated 21 acres (8.5 hectares). Approximately



58,000 cubic yards (44,400 cubic meters) of contaminated material are present.

Site History

The present owners of the Belfield site are the Burlington Northern Railroad Company and Gary Newton. The railroad or its predecessors has owned part of the site since 1888. Mr. Newton owns the north part of the site. Union Carbide Corporation leased the site for an ashing operation from 1964 to 1966. Dakota Industries leased the site in 1968 for clay drying operations to produce cat litter. In 1972, the L.P. Anderson Construction Co. of Miles City, Montana, purchased one of the buildings and leased a portion of the site for construction equipment, maintenance and storage. Another building, owned by Bob Newton, housed a honey processing operation. Cenex Exploration, an agricultural cooperative, maintains an oil and gas exploration office and shop adjacent to the site.

Remedial Action

The Belfield remedial action plan called for stabilizing the contaminated material in Bowman, ND along with additional material from the Bowman UMTRA Project site. This relocation of RRM to the Bowman site would have required transporting the material approximately 65 miles (105 kilometers).

As published in the *Federal Register*, the Secretary of Energy removed Belfield and Bowman as designated sites. This action was taken at the request of the State of North Dakota because of minimal public support, limited state funding, and the very small risk to the public and the environment. DOE prepared an Environmental Assessment and Finding of No Significant Impact in compliance with the National Environmental Policy Act.

Site Information

SCHEDULE MILESTONES

- (EA) FONSI: July 1997
- Final RAP: Not published

OTHER INFORMATION

- Proposed disposal option: Relocate to Bowman
- Date site acquired by state: N/A
- Volume of contaminated material: 158,000 cubic yards (121,000 cubic meters) at both North Dakota sites
- Average tailings radioactivity: 61 pCi/g, Ra-226
- Public participation issues: Unavailability of state funding for surface remediation.

VICINITY PROPERTIES

- Number included: 7
- Number completed: 0 (due to revocation of site designation)

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	1,527
Env. Health & Safety/NEPA	1,498
RA Design	992
Site Acquisition	—
RA Field Management	—
Site Preparation	—
Tailings Handling	—
Cover Material	—
Erosion Protection	—
Site Restoration	—
All Other Construction Costs	—
VP Design	1
VP Construction	—
Surveillance & Maintenance	1
Site Specific Total	$4,019

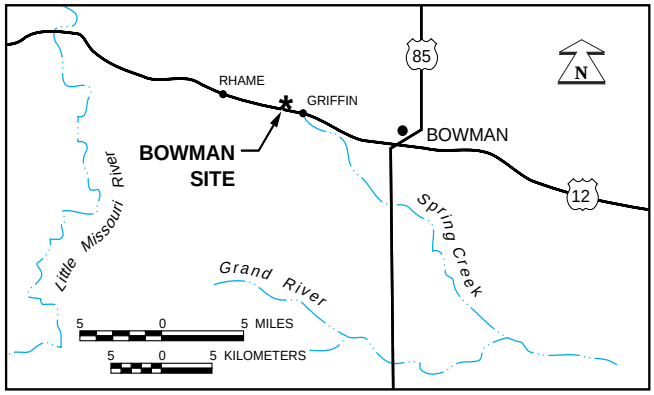
The ashing site at Belfield.

Bowman, North Dakota

Site Description

The former Bowman mill and tailings site is approximately 12 acres (4.9 hectares) in size and is located in southwestern North Dakota about seven miles (11.3 kilometers) west of Bowman at the Griffin siding of the Chicago, Milwaukee, St. Paul and Pacific Railroad. The site is located on nearly level land close to the head of Spring Creek, a part of the Grand River drainage basin.

Ash at the site, produced from lignite coal that was burned in a rotary kiln, contains uranium and radium. No tailings pond or pile is present because the ash product was shipped to Grants, NM for further processing. Windblown stack-released ash contaminated 59 acres (23.9 hectares). Some 100,000 cubic yards (76,500 cubic meters) of contaminated material remain on and adjacent to the site.



Site History

During ashing operations, the site was owned by Viola Soderstrom who leased the property in 1963 to Kermac Nuclear Fuels Corporation, a subsidiary of Kerr-McGee Oil Industries. Ashing operations were carried on from 1963 to 1967. The property was subsequently purchased by The Milwaukee Road and leased by Bowman Grain, Inc. Roger Stearns and Stanley Soderstrom have owned most of the site since 1978.

Remedial Action

The Bowman remedial action plan called for consolidating and stabilizing the contaminated material on the Bowman site along with contaminated material transported from the Belfield, ND ashing site, approximately 65 miles (105 kilometers) away.

As published in the *Federal Register*, the Secretary of Energy removed Belfield and Bowman as designated sites. This action was taken at the request of the State of North Dakota because of minimal public support, limited state funding and the very small risk to the public and the environment. DOE prepared an Environmental Assessment and Finding of No Significant Impact in compliance with the National Environmental Policy Act.

Site Information

SCHEDULE MILESTONES

- (EA) FONSI: July 1997
- Final RAP: Not published

OTHER INFORMATION

- Proposed disposal option: Stabilize in place along with contaminated material from Belfield site
- Date site acquired by state: N/A
- Volume of contaminated material: 158,000 cubic yards (121,000 cubic meters) at both North Dakota sites
- Average tailings radioactivity: 32 pCi/g, Ra-226
- Public participation issues: Unavailability of state funding for surface remediation.

VICINITY PROPERTIES

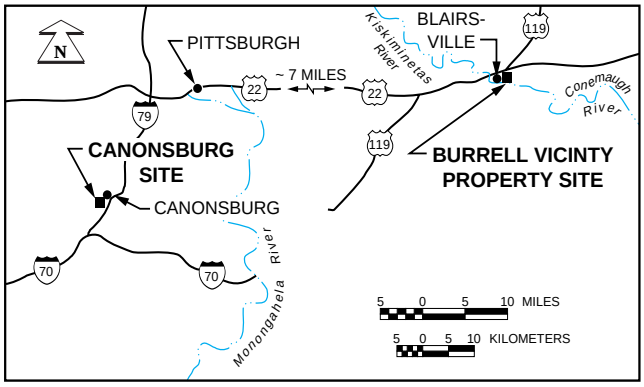
- Number included: 1
- Number completed: 0 (due to revocation of site designation)

The ashing site at Bowman.

Canonsburg, Pennsylvania

Site Description

The 30-acre (12.1 hectares) Canonsburg site lies between Chartiers Creek and the ConRail tracks in the Borough of Canonsburg in southwestern Pennsylvania. About 54,000 cubic yards (41,300 cubic meters) of RRM from the site were moved by ConRail to a nine-acre (3.6 hectares) site in Burrell Township between October 1956 and January 1957. The Burrell site is about one mile (1.6 kilometers) east of Blairsville, PA, between the Conemaugh River and the ConRail tracks.



Site History

The Canonsburg site was operated as a radium extraction plant by Standard Chemical from 1911 to 1922. Later, Vitro Corporation of America acquired the property and processed ore to extract radium and uranium salts. From 1942 until 1957, Vitro was under contract to the federal government to recover uranium from ore and scrap. For the next nine years, the site was used only for storage under an Atomic Energy Commission contract. In 1967, the property was purchased by the Canon Development Company and was leased to tenant companies for light industrial use. Currently, the site is owned by the federal government.

Remedial Action

Remedial action at the Canonsburg site began in October 1983 and consisted of placing the RRM in a disposal cell designed to meet EPA longevity standards for 200 to 1,000 years of safe storage. The cell occupies six acres (2.4 hectares). Remedial action at the Canonsburg processing site was completed in December 1985. The RRM at the Burrell Township vicinity property was stabilized in place with its own cover system. Remedial action was completed in July 1987. The NRC licensed the Burrell site in May 1994 and the Canonsburg site in January 1996.

The Canonsburg site is located in a residential area. Due to public concern, the decision was made to not relocate the tailings to a remote location and instead to build a disposal cell to stablize the material in place.

The Commonwealth of Pennsylvania transfered the title for the disposal site land to the federal government. DOE is responsible for long-term surveillance of the disposal cell. To accomplish that, DOE transferred responsibility for the Burrell and Canonsburg sites to its Grand Junction Office, in Grand Junction, CO in September 1994 and April 1996, respectively.

Site Information

The Canonsburg disposal site consisted of three parcels and these were acquired by the Commonwealth of Pennsylvania in 1983. Sixteen adjacent properties were acquired by the U.S. Army Corps of Engineers between November 29, 1983, and May 31, 1984.

CANONSBURG SCHEDULE MILESTONES

- (EIS) ROD: October 1983
- Final RAP: October 1983
- Date contractor mobilized: October 1983
- Date contractor demobilized: December 1985
- Date mill site certified: August 1995
- Date Canonsburg disposal cell licensed: January 1996

CANONSBURG CELL STATISTICS

- Method of containment: Stabilize in place
- Volume of material handled: 265,000 cubic yards (202,800 cubic meters)
- Volume of contaminated material in cell: 265,000 cubic yards (202,800 cubic meters)
- Volume of uncontaminated material (backfill) handled: 198,551 cubic yards (151,914 cubic meters)
- Average tailings radioactivity: 2,315 pCi/g, Ra-226
- Total radioactivity in cell: 100 Curies, Ra-226
- Cell dimensions: The Canonsburg disposal cell is roughly pentagonal in shape and is approximately

800 feet (245 meters) long by 780 feet (240 meters) wide.

- Cell design: The disposal cell has a one foot (0.3 meters) thick capillary break and a clay liner to protect ground water from contamination by RRM. The tailings were placed atop the liner and cov ered with three feet (0.91 meters) of clay, soil and a bentonite mixture, which serves to prevent the escape of radon gas from the tailings and the penetration of water into the cell. On top of the radon barrier are one foot (0.3 meters) of riprap (top slopes) and two feet (0.6 meters) of riprap (side slopes), and a soil layer one foot (0.3 meters) thick which was vegetated with native grass.

CANONSBURG CONSTRUCTION STATISTICS

- Estimated risk reduction: 15 deaths prevented
- Safety record:
  - Total Recordable Rate - 0.9
  - Total Lost Workday Rate - 0.0
- Remediation subcontractor:
- Contaminated Material:
  - Equipment & method: Scrapers and 40T Off-Highway ED trucks
  - Haul distance: less than one mile (1.6 kilometers)
- Cover Material:
  - Radon barrier
    - Quantity: 28,200 tons (25,600 metric tons).
- Erosion Protections
  - Bedding quantity: 16,450 tons (14,900 metric tons)

The mill site at Canonsburg, Pennsylvania, before remediation.

The mill site at Canonsburg, Pennsylvania, after remediation.

- Type A Quantity : 43,500 tons (39,500 metric tons)

OTHER INFORMATION

- Vicinity properties cleaned up: 163
- VP material volume: 35,342 cubic yards (27,041 cubic meters)
- Public participation issues: Site located in residential area. Due to public pressure, decision was made to not relocate the tailings to a remote location and instead to build a disposal cell to stabilize the material in place. Adequate state funding of surface remediation.

BURRELL SCHEDULE MILESTONES

- (EIS) ROD: October 1983
  *Canonsburg EIS proposed action had Burrell materials to be covered in place as a vicinity property.
- Final Radiological and Engineering Assessment: September 1986
- Date contractor mobilized: 1986
- Date contractor demobilized: July 1987
- Date Burrell disposal site licensed: May 1994

BURRELL CELL STATISTICS

- Method of containment: Stabilize in place
- Volume of material handled: 40,000 cubic yards (30,600 cubic meters)
- Volume of contaminated material in cell: 54,019 cubic yards (41,331 cubic meters)
- Average tailings radioactivity: 70 pCi/g, Ra-226
- Total radioactivity in cell: 4 Curies, Ra-226
- Cell dimensions: The Burrell disposal cell is roughly oblong in shape. It stands 20 feet (6 meters) above the surrounding terrain and varies in depth from 3 to 25 feet (1 to 7.6 meters).
- Cell design: The tailings were covered with three feet (0.9 meters) of clay, which serves to prevent the escape of radon gas from the tailings and the penetration of water into the cell. On top of the radon barrier are 12 inches (0.3 meters) of bedding layer and 12 inches (0.3 meters) of riprap.

BURRELL CONSTRUCTION STATISTICS

- Remediation subcontractor: Joeseph Bacarello and Sons
- Contaminated Material:
  - Equipment & method: Bulldozers and sheeps foot rollers
  - Haul distance: less than one mile (1.6 kilometers)
- Cover Material:
  - Radon barrier
    - Equipment: Caterpillar 973 track loader and sheeps foot roller
    - Source: Blue Jay Borrow Pit
    - Quantity: 26,000 cubic yards (19,900 cubic meters)
- Erosion Protection:
  - Bedding
    - Source: Torrance rock quarry
    - Type material: G-1 and G-2
    - Haul distance: 5 miles (8 kilometers)
    - Quantities: G-1, 19,024 cubic yards (14,555 cubic meters); G-2, 5,696 cubic yards (4,358 cubic meters)
  - Riprap
    - Source: Torrance rock quarry
    - Type material: R-1 and R-3
    - Haul distance: 5 miles (8 kilometers)
    - Quantities: R-1, 15,482 cubic yards (11,845 cubic meters); R-3, 1,340 cubic yards (1,025 cubic meters)

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	2,682
Env. Health & Safety/NEPA	888
RA Design	962
Site Acquisition	4,833
RA Field Management	3,521
Site Preparation	2,635
Tailings Handling	633
Cover Material	2,196
Erosion Protection	1,960
Site Restoration	688
All Other Construction Costs	697
VP Design	3,748
VP Construction	8,372
Surveillance & Maintenance	1,186
Site Specific Total	$35,001

The mill site at Burrell, Pennsylvania, before remediation.

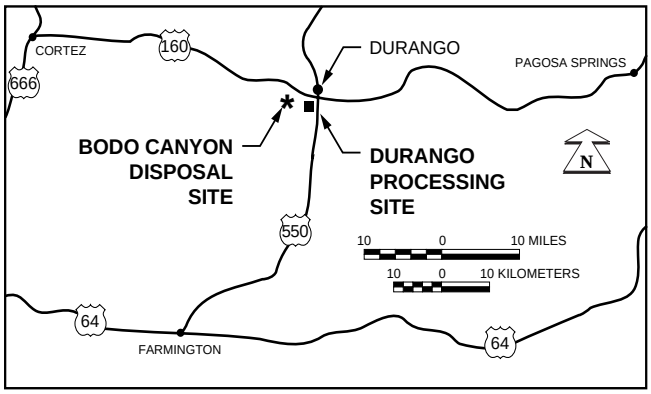
The mill site at Burrell, Pennsylvania, after remediation.

Durango, Colorado

Site Description

The former Durango uranium processing site is located just outside the city limits of Durango in southwest Colorado. The site is bordered on the east by the Animas River, on the north by Lightner Creek and on the southwest by Smelter Mountain. Two tailings piles were located on the 147-acre (59.5 hectares) site.

Prior to the cleanup, the two tailings piles contained about 1.2 million cubic yards (920,000 cubic meters)



of RRM and covered 10 acres (4 hectares) of the site. The mill site and ore storage area covered about eight acres (3.2 hectares). A raffinate pond (a basin to contain spent liquids from the milling process) was located nearly one-half mile (0.8 kilometers) southeast of the mill site and covered about 15 acres (6.1 hectares).

Site History

The original mill was built on the site of an old lead smelter that operated from 1880 to 1930. The uranium mill was designed and built by the Vanadium Corporation of America (VCA) in 1942 to furnish vanadium to the Metals Reserve Company, a company established by the U.S. government for the purchase of strategic materials needed during World War II. In 1943, the vanadium tailings were reprocessed by VCA to recover uranium for use in the Manhattan Project.

The original mill operated until 1946 and was shut down until 1949 when VCA contracted to sell uranium to the Atomic Energy Commission. VCA leased and then later purchased the property. Plant operation continued until March 1963, when the mill was shut down permanently. In 1967, the Foote Mineral Company purchased the mill and adjoining property. In 1976 and 1977, the site, except for two small parcels, was purchased by Ranchers Exploration and Development Corporation of Albuquerque, NM. The two parcels were deeded to the Colorado Highway Department and La Plata Electric Company. In 1984, Rancher's Exploration was acquired by Hecla Mining Company. The State of Colorado was granted ownership of the processing site in 1990.

Remedial Action

Cleanup at Durango began in October 1986 and was completed in May 1991. All RRM was transported by truck to an isolated disposal site at Bodo Canyon, CO. The cleaned up areas of the site were backfilled with uncontaminated soil to an elevation compatible with the surrounding terrain, recontoured to promote surface drainage and revegetated. The top of the cell was a vegetative design, to take advantage of the effect of evapotransporation. Archeological resources that were discovered included a Native American burial site. As a phased approach for construction, no work was conducted during critical elk and deer wintering over at the disposal site. The NRC licensed the Durango site in September 1996.

Site Information

The Bodo Canyon site was acquired by the state in two tracts. The first was acquired from the Colorado Department of Natural Resources, Division of Wildlife, on August 4, 1987. The second was acquired from the state land board through a real estate exchange agreement dated May 15, 1990. The disposal cell was permanently transferred to the federal government in 1996.

SCHEDULE MILESTONES

- (EIS) ROD date: 1985
- Date contractor mobilized: December 1986
- Date contractor demobilized: May 1991
- Final RAP: May 1994
- Date mill site certified: June 1996
- Date disposal cell licensed: September 1996

CELL STATISTICS:

- Method of containment: Relocated to Bodo Canyon
- Volume of material handled: 2,532,586 cubic yards (1,937,709 cubic meters)
- Volume of contaminated material in cell: 2,532,586 cubic yards (1,937,709 cubic meters)
- Volume of uncontaminated material (fill material) handled: 1,168,448 cubic yards (893,992 cubic meters)
- Average tailings radioactivity: 671 pCi/g, Ra-226
- Total radioactivity in cell: 1,400 Curies, Ra-226
- Cell dimensions: Bodo Canyon disposal site comprises 120.6 acres (48.8 hectares). The disposal cell is roughly rectangular in shape, and is 2,200 feet (670 meters) long by 1,100 feet (335 meters) wide. It is constructed partially below grade and is approximately 90 feet (27 meters) from its highest to its lowest point.
- Cell design: The cell is capped with a 6- to 7-foot (1.8 to 2.1 meters) thick, multilayered cover. The tailings were encapsulated with a compacted 2-foot (0.6 meters)-thick radon barrier of uncontaminated

The mill site at Durango before remediation.

The mill site at Durango after remediation.

silty clay and clay materials.

On the sideslope, the upper 18 inches (0.46 meters) of the radon barrier were amended with seven percent bentonite. Additionally, the topslope was constructed with a geosynthic clay liner (bentonite sandwiched between two geotextiles) on the surface to restrict infiltration into the RRM. The radon barrier was further protected by a 6-inch (0.15 meter) sand filter/drainage layer on the sideslopes and top.

The topslope was completed with a 1.5-foot (0.46 meter) biointrusion layer of Type A riprap, a 2.5-foot (0.76 meter) frost protection layer and a 6-inch (0.15 meter) rock/soil matrix layer covered with native grasses. The sideslope was completed with a 6-inch (0.15 meter) bedding layer, a 1.5-foot (0.46 meter) frost protection layer, another 6-inch (0.15 meter) bedding layer and 1-foot (0.3 meter) layer of rock (Type B riprap).

Seepage problems with the construction of the disposal cell lead to the design and operation of a toe drain.

CONSTRUCTION STATISTICS

- Truck miles driven: 915,336 (1,476,348 kilometers)
- Estimated risk reduction: 22 deaths prevented
- Peak employment level: 180
- Safety record:
  - Total Recordable Rate - 5.5
  - Total Lost Workday Rate - 1.6
- Remediation subcontractor: Nielsons, Inc.
- Contaminated material:
  - Method of containment: Relocate to Bodo Canyon
  - Equipment & method: Highway truck and belly dump trailer
  - Haul distance: 4 miles (6.5 kilometers)
- Cover Material:
  - Radon barrier
    - Source: On-site borrow
    - Type material: Clay
    - Haul distance: 2,000 feet (610 meters)
    - Equipment & method: Scrapers
    - Quantity: 103,412 cubic yards (79,122 cubic meters)
    - Bentonite %: 7%
  - Frost barrier
    - Source: On-site borrow
    - Type material: Clay
    - Haul distance: 2,000 feet (610 meters)
    - Equipment & method: Scrapers
    - Quantity: 102,618 cubic yards (78,514 cubic meters)
- Erosion Protection:
  - Bedding
    - Source: Borrow
    - Type material: Mixed gravels
    - Haul distance: 5 miles (8 kilometers)

The cell at Bodo Canyon following completion.

-- Quantity: 45,673 cubic yards (34,945 cubic meters) bedding; 28,476 cubic yards (21,787 cubic meters) drain
-- Gradation: 1-1/2 inches (3.8 centimeters) minus

- Type A
-- Source: Borrow
-- Type material: Mixed gravels
-- Haul distance: 5 miles (8 kilometers)
-- Quantity: 39,643 cubic yards (30,331 cubic meters)
- Type B
-- Source: Borrow
-- Type material: Mixed gravels
-- Haul distance: 5 miles (8 kilometers)
-- Quantity: 55,294 cubic yards (42,306 cubic meters)
- Type C
-- Source: Borrow
-- Type material: Mixed gravels
-- Haul distance: 5 miles (8 kilometers)
-- Quantity: 4,660 cubic yards (3,565 cubic meters)

OTHER INFORMATION

- Vicinity properties cleaned up: 129
- VP material handled: 123,389 cubic yards (94,406 cubic meters)
- Citizen advisory committee: Durango Citizens Advisory Council
- Public participation issues: Initial disposal cell was designed to stabilize the RRM in place. Following the passage of the EPA groundwater regulations, a new design was developed to relocate the RRM to a site in Bodo Canyon.

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	4,446
Env. Health & Safety/NEPA	1,872
RA Design	2,924
Site Acquisition	726
RA Field Management	6,481
Site Preparation	4,230
Tailings Handling	11,154
Cover Material	2,391
Erosion Protection	2,201
Site Restoration	2,096
All Other Construction Costs	7,782
VP Design	1,564
VP Construction	4,815
Surveillance & Maintenance	801
Site Specific Total	$53,483

Edgemont, South Dakota

Site Description

The Edgemont mill site is located in southwest South Dakota immediately east of the city of Edgemont, in Fall River County. It is 85 miles (137 kilometers) southwest of Rapid City, South Dakota. Cottonwood Community, along Cottonwood Creek, is just south of where the old mill building used to sit on the 213-acre (86 hectares) site. The mill produced about 2.3 million tons (2.1 million metric tons) of tailings which were stabilized by the mill operators after it shut down.

Site History

The mill was constructed in 1956 to extract uranium from uranium ore and was operated by Mines Development, Inc., a subsidiary of Susquehanna-Western, Inc. In 1960, a vanadium recovery process was added. Uranium processing ended in 1972 and vanadium processing was shut down in August 1974 when the plant was purchased by the Tennessee Valley Authority (TVA). No ore processing has occurred since then.

Remedial Action

There was no remedial action taken by the DOE at the Edgemont site. The RRM was stabilized on the site by the owners prior to the enactment of the UMTRCA.

UMTRCA was amended in 1983 to include cleanup of all off-site properties contaminated with tailings from the Edgemont site. These properties, called vicinity properties, were residences, commerical buildings or open lands where tailings were used as construction materials, or where tailings were carried from the site by wind or water erosion.

DOE identified 137 VPs in the Edgemont area. These were cleaned up by removing the RRM and transporting it to the TVA Title II disposal site for permanent stabilization.

Site Information

SCHEDULE MILESTONES

- Not applicable

OTHER INFORMATION

- Vicinity properties cleaned up: 137
- VP material volume: 12,000 cubic yards (9,180 cubic meters)
- Estimated risk reduction: 5.5 deaths prevented
- Citizen advisory committee: None
- Public participation issues: None

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	213
Env. Health & Safety/NEPA	6
RA Design	—
Site Acquisition	—
RA Field Management	716
Site Preparation	—
Tailings Handling	—
Cover Material	—
Erosion Protection	—
Site Restoration	—
All Other Construction Costs	—
VP Design	818
VP Construction	3,165
Surveillance & Maintenance	—
Site Specific Total	$4,918

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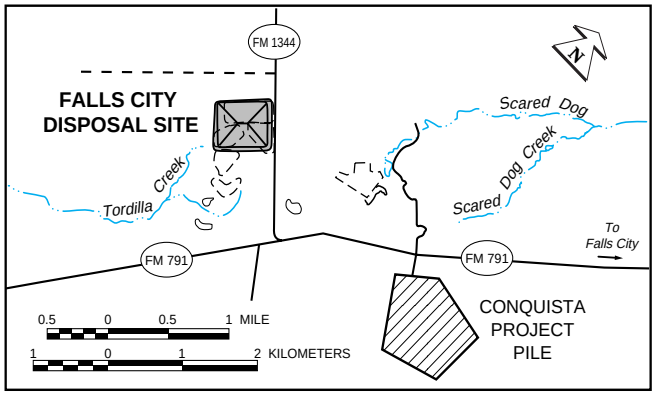
Falls City, Texas

Site Description

The former Falls City mill and tailings site is located in Karnes County, 46 miles (74 kilometers) southeast of San Antonio and approximately eight miles (13 kilometers) southwest of Falls City, Texas. The site consisted of two parcels. Parcel A was 473 acres (191.5 hectares) and contained tailings piles 1, 2, 4, 5 and 7, and an old pit mine pond (#6). Parcel B was 134



acres (54.3 hectares) and contained tailings pile 3. Parcel B was nearly one mile (1.6 kilometers) east of Parcel A.

Site History

The original mill was built and operated by Susquehanna-Western, Inc., of San Antonio, Texas, from 1961 to 1973. Between 1978 and 1982, Solution Engineering, Inc., conducted secondary solution mining from four tailings piles. In 1982, all the piles were covered with about one and one-half feet (0.46 meters) of soil, and revegetated. The state of Texas now owns the mill site and some of the adjacent properties. The surface rights to Parcel B are privately held and remain in private ownership following remedial action.

Remedial Action

Cleanup at Falls City began in January 1992. It involved consolidating all of the RRM into a single stabilized tailings pile on the mill site. Most of the RRM was stabilized in place, the remaining RRM was relocated from an adjacent property. The RRM from Parcel B was transported to Parcel A, where a disposal cell was constructed to meet EPA requirements for longevity, control of radon emissions and ground water protection. A vegetative top cover was used following a cost-saving suggestion to not use a rock cover. The cleanup was completed in June 1994 and the disposal cell was closed. The NRC licensed the site in July 1997.

Site Information

The state acquired the 231.15-acre (93.6 hectares) disposal site in three parcels. The first 153.15-acre (62 hectares) parcel was acquired from Solution Engineering, Inc., on April 27, 1990; the second 34.32-acre (13.9 hectares) parcel was acquired from Jimmie E. Nix on March 6, 1991; and the third 43.68-acre (17.7 hectares) parcel was acquired from Solution Engineering on March 13, 1991. The state deeded the disposal cell property to the federal government on June 5, 1997.

SCHEDULE MILESTONES

- (EA) FONSI: January 1992
- Date contractor mobilized: February 1992
- Final RAP: September 1992
- Date contractor demobilized: July 1994
- Date mill site certified: April 1997
- Date disposal cell licensed: July 1997

CELL STATISTICS

- Method of containment: Stabilize in place
- Volume of contaminated material handled: 3,528,000 cubic yards (2,699,300 cubic meters)
- Volume of contaminated material in cell: 6,018,963 cubic yards (4,605,174 cubic meters)
- Average tailings radioactivity: 189 pCi/g, Ra-226
- Total radioactivity in cell: 1,277 Curies, Ra-226
- Cell dimensions: The Falls City disposal cell covers approximately 127 acres (51.4 hectares) and was constructed above ground. It is rectangular in shape, and is 2,600 feet (790 meters) long and 2,200 feet (670 meters) wide. It rises some 45 feet (14 meters) above the surrounding terrain.
- Cell design: The cell is capped by a multi-component cover which features a grass top and rock sides. The cover was six feet (1.8 meters) thick on top of the cell and three feet, ten inches (1.17 meters) thick on the sides. The top slope area was covered with a 3-foot (0.91 meters) radon/infiltration barrier of clayey soil. The vegetated erosion protection layer

consists of 30 inches (0.76 meters) of soil and six inches (0.15 meters) of topsoil. The maximum grade of the topslopes is one percent.

The slideslopes consist of a 2-foot (0.6 meters) radon barrier, a 6-inch (0.15 meters) bedding layer and an erosion protection layer consisting of 16 inches (0.4 meters) of rock (Type B riprap). Sideslopes are graded to 20 percent.

CONSTRUCTION STATISTICS

- Truck miles driven: 46,707 (75,334 kilometers)
- Estimated risk reduction: 2.3 deaths prevented
- Peak employment level: 142
- Safety record:
  - Total Recordable Rate - 9.3
  - Total Lost Workday Rate - 2.5
- Remediation subcontractor: Gilbert, Texas Construction Corporation
- Contaminated material:
  - Equipment & method: Scrapers, off-highway end dump trucks
  - Haul distance: 500 to 5,000 feet (150 to 1520 meters)

The mill site at Fall City before remediation.

The mill site at Fall City after remediation.

- Cover Material:
  - Radon barrier, growth medium, and topsoil
    - Source: Borrow
    - Type material: Clay
    - Haul distance: 5,000 feet (1520 meters)
    - Equipment & method: Scrapers
    - Quantity: 546,893 cubic yards (418,433 cubic meters) radon barrier; 361,383 cubic yards (276,498 cubic meters) growth medium; 70,132 cubic yards (53,659 cubic meters) topsoil
    - Bentonite %: None
  - Frost barrier: None
- Erosion Protection:
  - Bedding
    - Source: Marble Falls Quarry
    - Type material: Crushed dolomite
    - Haul distance: 150 miles (242 kilometers), rail to truck
    - Quantity: 32,622 cubic yards (24,959 cubic meters)
    - Gradation: 3 inches (7.6 centimeters) minus
  - Type A: None
  - Type B
    - Source: Marble Falls Quarry
    - Type material: Crushed dolomite
    - Haul distance: 150 miles (242 kilometers), rail to truck
    - Quantity: 95,295 cubic yards (72,911 cubic meters)
    - Gradation: 13 inches (33.0 centimeters) minus
  - Type C
    - Source: Marble Falls Quarry
    - Type material: Crushed dolomite
    - Haul distance: 150 miles (242 kilometers), rail to truck
    - Quantity: 44,412 cubic yards (33,980 cubic meters)
    - Gradation: 20 inches (50.8 centimeters) minus

OTHER INFORMATION

- Vicinity properties cleaned up: 13
- VP material handled: 523 cubic yards (400 cubic meters)
- Citizen advisory committee: Falls City UMTRA Project Task Force
- Public participation issues: Groundwater protection

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	4,267
Env. Health & Safety/NEPA	1,068
RA Design	2,516
Site Acquisition	500
RA Field Management	6,894
Site Preparation	2,850
Tailings Handling	7,459
Cover Material	2,187
Erosion Protection	7,034
Site Restoration	4,431
All Other Construction Costs	2,172
VP Design	42
VP Construction	34
Surveillance & Maintenance	133
Site Specific Total	$41,587

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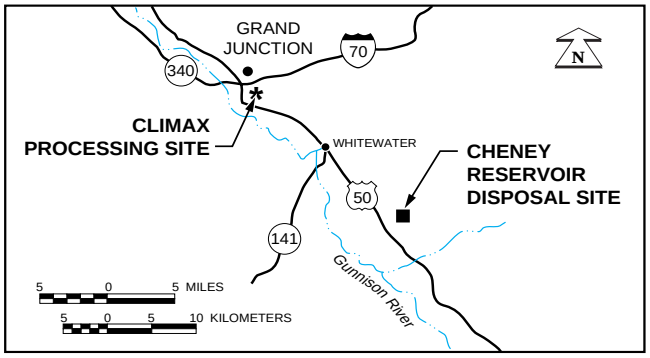
Grand Junction, Colorado

Site Description

The former Grand Junction mill and tailings site, also known as the Climax site, is a 114-acre (46.2 hectares) tract located in the Grand Valley of Mesa County, CO. The site is in an industrial area of the city of Grand Junction on the north bank of the Colorado River. It contained one large tailings pile and a remaining mill building. The RRM from vicinity properties was hauled to the state repository located northeast of the pile. The total volume of RRM removed to a disposal cell near Cheney Reservoir was approximately 2.5 million cubic yards (1.9 million cubic meters).



Site History

The site was originally a sugar beet refinery of approximately 200 acres (81 hectares). In 1951, Climax Uranium Company, a division of American Metals Climax (now known as AMAX, Inc.), started milling operations at the site. After the mill was shut down in March 1970, 85 acres (34.4 hectares) were developed into an industrial park, 40 acres (16.2 hectares) were deeded to the State of Colorado as a repository for tailings from VP remedial action projects in the Grand Junction area and 10 acres (4 hectares) were sold to a private citizen. The majority of the former tailings site is presently owned by the State of Colorado, with seven acres (2.8 hectares) privately owned.

Remedial Action

Remedial action at the Grand Junction site involved relocating the RRM to the Cheney disposal site approximately 17 miles (27 kilometers) southeast of Grand Junction. Phase I remedial action began in December 1988 and included building demolition, construction of decontamination facilities and other site preparation at the Climax site.

Phase II remediation began in December 1989 and was completed in August 1994. The RRM was transported from the Climax site by truck to a nearby rail spur and loaded onto railcars. The trains hauled the RRM to a spur near the Cheney disposal site. The contaminated material was loaded into trucks for the final haul to the disposal cell. The project trucks traveled more than 3.2 million miles (5.13 million kilometers) across area roads. More than 5,300 trainloads of RRM were moved to the disposal site.

In 1994, the cleaned up areas of the Climax site were backfilled with uncontaminated soil to a level compatible with the surrounding terrain, recontoured to promote surface drainage and revegetated. The restoration plan was coordinated with the Grand Junction Riverfront Commission to be compatible with long-range plans for development of a riverfront park.

The NRC certified the former processing site as clean in March 1997. The Cheney disposal cell will remain open for disposal of vicinity property radioactive material until September 2023, or until the cell is filled to its design capacity.

Site Information

Date site acquired: The disposal site is located on public land formerly administered by the BLM. It was transferred to DOE on February 13, 1990.

SCHEDULE MILESTONES

- (EIS) ROD: December 1986
- Date contractor mobilized: April 1989
- Final RAP: September 1991
- Date contractor demobilized: August 1994
- Date mill site certified: March 1997
- Date disposal cell licensed: Cell will be licensed following closure of the cell no later than September 2023.

CELL STATISTICS

- Method of containment: Relocate to Cheney disposal site
- Volume of contaminated material handled: 4,425,244 cubic yards (3,385,803 cubic meters)
- Volume of contaminated material in cell: 4,425,244

cubic yards (3,385,803 cubic meters)
- Volume of uncontaminated material (fill material) handled at processing site: 1,455,360 cubic yards (1,113,510 cubic meters)
- Average tailings radioactivity: 665 pCi/g, Ra-226
- Total radioactivity in cell: To be determined when cell is closed in 2023.
- Cell dimensions: The Cheney disposal cell covers 94 acres (38 hectares), is roughly rectangular in shape and is approximately 2,400 feet long (730 meters) by 1,800 feet wide (550 cubic meters). It is constructeded partially below grade and rises some 40 feet (12 meters) above the surrounding terrain. It is approximately 80 feet (24 meters) deep from its highest to its lowest point.
- Cell design: The top of the disposal cell is capped with a 7-foot (2.1 meters)-thick, multi-component cover. A 1.5-foot (0.45 meters) transition layer of

The mill site at Grand Junction before remediation.

The mill site at Grand Junction after remediation.

off-pile materials was placed on top of the RRM. Then a 2-foot (0.6 meters)-thick radon/infiltration layer was placed over the transition materials. This layer, constructed of selected on-site materials obtained from the embankment foundation excavation, is designed to control radon flux and minimize water infiltration. A 2-foot (0.6 meters) frost protection layer was placed next to prevent the adverse effects of freeze-thaw cycles. A 6-inch (0.15 centimeter) coarse-grained bedding layer was then placed to serve asa capillary break, promote drainage and prevent damage from the erosion-protection layer. A 12-inch (0.3 meter) erosion protection layer of rock (Type A riprap) was then placed to protect against wind and water erosion. Maximum grade is 2.3 percent on the topslopes and 20 percent on the sideslopes.

A cell-closure hole was incorporated into the tailings embankment to allow for placement of approximately 500,000 cubic yards (382,000 cubic meters) of additional contaminated material from vicinity properties. Clean fill dikes, sloped at 20 percent, contain the above-grade portion of the cell.

CONSTRUCTION STATISTICS

- Truck miles driven: 3,210,465 (5,178,169 kilometers)
- Estimated risk reduction: 588 deaths prevented
- Peak employment level: Approximately 800
- Safety record:
  - Total Recordable Rate - 5.1
  - Total Lost Workday Rate - 0.9
- Remediation subcontractor: Industrial Constructors Corporation
- Contaminated material
  - Equipment & method: Rail to truck
  - Haul distance: 20 miles (32 kilometers); (10 miles [16 kilometers] rail, 10 miles [16 kilometers] truck)
- Cover Material:
  - Radon barrier
    - Source: Borrow
    - Type material: Clay
    - Haul distance: 3,500 feet (1,070 meters)
    - Equipment & method: Scrapers
    - Quantity: 203,000 cubic yards (155,300 cubic meters) radon barrier; 145,000 cubic yards (110,900 cubic meters) transition layer
    - Bentonite %: None
  - Frost barrier
    - Source: Borrow
    - Type material: Clay
    - Haul distance: 3,500 feet (1,070 meters)
    - Equipment & method: Scrapers
    - Quantity: 203,000 cubic yards (155,300 cubic meters)
    - Bentonite %: None
- Erosion Protection:

The disposal cell at Cheney Reservoir during 1998.

- Bedding
  - Source: Alluvial off-site
  - Type material: River run
  - Haul distance: 30 miles (48 kilometers)
  - Quantity: 61,615 cubic yards (47,142 cubic meters)
  - Gradation: 3 inches minus (7.6 centimeters)
- Type A
  - Source: Borrow
  - Type material: Basalt
  - Haul distance: 2,000 feet (610 meters)
  - Quantity: 64,813 cubic yards (49,589 cubic meters)
  - Gradation: 4 inches minus (10.2 centimeters)
- Type B
  - Source: Borrow
  - Type material: Basalt
  - Haul distance: 2,000 feet (610 meters)
  - Quantity: 45,210 cubic yards (34,591 cubic meters)
  - Gradation: 12 inches minus (30.5 centimeters)
- Type C
  - Source: Borrow
  - Type material: Basalt
  - Haul distance: 2,000 feet (610 meters)
  - Quantity: 30,549 cubic yards (23,373 cubic meters)
  - Gradation: 28 inches minus (71.1 centimeters)

OTHER INFORMATION:

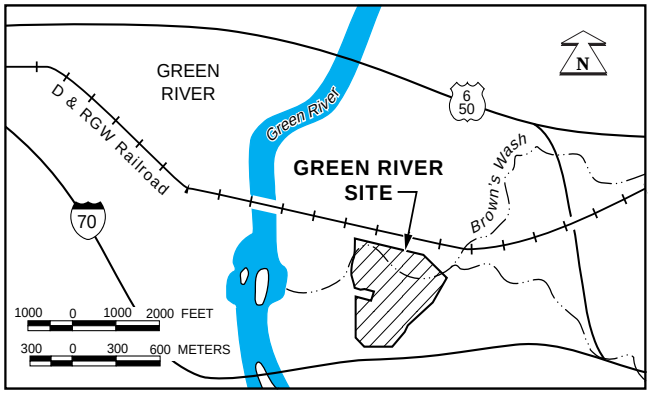
- Vicinity properties cleaned up: 4,266
- VP material handled: 1,900,000+ cubic yards (1,454,000 cubic meters) to date
- Citizen advisory committee: Grand Junction Citizens Advisory Group
- Public participation issues: Safety concerns with transporting RRM on city streets and highways were resolved by using a combination of tracks and trains to perform the haul. Disposal cell left open to receive VP materials through 2023.

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	30,215
Env. Health & Safety/NEPA	3,419
RA Design	5,400
Site Acquisition	1,065
RA Field Management	42,420
Site Preparation	12,020
Tailings Handling	65,252
Cover Material	788
Erosion Protection	6,284
Site Restoration	9,100
All Other Construction Costs	20,764
VP Design	54,912
VP Construction	198,804
Surveillance & Maintenance	56
Site Specific Total	$450,499

Green River, Utah

Site Description

The former Green River mill and tailings site is located in the east-central portion of Utah in Grand County. The site is one mile (1.6 kilometers) southeast of the city of Green River and 70 miles (113 kilometers) west of the Utah-Colorado border. The site covers approximately nine acres (3.6 hectares). The U.S. Army's White Sands Missile Range Utah Launch Complex utilizes most of the vacant land south and east of the site.



Site History

Union Carbide built the uranium mill in 1958 and operated it until the owners shut it down in 1961. Later, the mill buildings were used for assembly of missile components for the Utah Launch Complex. The State of Utah acquired ownership of the mill and tailings site in 1988. The site is currently owned by the federal government.

Remedial Action

The remedial action of the Green River site involved consolidating and stabilizing the tailings in a disposal cell located on the flood plain of Brown's Wash, approximately 500 feet (150 meters) south of the former tailings pile location. The RRM was encapsulated using a three-foot (0.9 meters) radon barrier cover with an additional 18 inches (0.46 meters) of rock. Remedial action began in November 1988 and was completed in December 1989.

Site Information

Date site acquired by state: The State of Utah acquired the disposal site from Umetco Minerals Corp. in 1988. The state conveyed title of the site to the federal government on October 26, 1996.

SCHEDULE MILESTONES

- (EA) FONSI: 1988
- Date contractor mobilized: September 1988
- Date contractor demobilized: December 1989
- Date mill site certified: July 1992
- Final RAP: March 1998
- Date disposal cell licensed: August 1998

CELL STATISTICS

- Method of containment: Stabilize on-site
- Volume of contaminated material handled: 382,000 cubic yards (292,300 cubic meters)
- Volume of contaminated material in cell: 382,000 cubic yards (292,300 cubic meters)
- Volume of uncontaminated material (fill) handled at processing site: 57,256 cubic yards (43,807 cubic meters)
- Average tailings radioactivity: 76 pCi/g, Ra-226
- Total radioactivity in cell: 30 Curies, Ra-226
- Cell dimensions: The Green River disposal cell covers approximately five acres (2 hectares), is rectangular in shape, and is 530 feet (162 meters) long and 450 feet (137 meters) wide. It is constructed partially below grade and rises some 40 feet (12 meters) above the surrounding terrain. It is approximately 95 feet (29 meters) deep from its highest to its lowest point.
- Cell design: There is a 6 foot (1.8 meters) thick uncontaminated soil buffer layer at the bottom of the cell over bedrock. The cell has a 4.5-foot (1.4 meters)-thick multi-layered cover. Contaminated materials are covered with 3-foot (0.91 meters) radon/infiltration of a compacted clay and bentonite mixture. The top and sideslopes are covered with a 6-inch (0.15 meters) bedding layer of sand and gravel, and a 1-foot (0.3 meter) erosion protection layer of rock (Type A riprap). Side-slopes are graded to 20 percent.

CONSTRUCTION STATISTICS

- Estimated risk reduction: 0.007 deaths prevented
- Safety record:
  - Total Recordable Rate - 3.9
  - Total Lost Workday Rate - 0.0

- Remediation subcontractor: CDK Contracting Company
- Cover Material:
  - Radon barrier
    - Source: Borrow
    - Type material: Silty Clay
    - Haul distance: 5,000 feet (1500 meters)
    - Equipment & method: Scrapers
    - Quantity: 27,911 cubic yards (21,355 cubic meters)
    - Bentonite %: 6%
  - Frost barrier: None
- Erosion Protection:
  - Bedding
    - Source: Borrow
    - Type material: River run gravels
    - Haul distance: 4 miles (6.5 kilometers)
    - Quantity: 4,718 cubic yards (3,610 cubic meters)
    - Gradation: 1 inch (2.54 centimeters) minus
  - Type A
    - Source: Fremont Junction, UT
    - Type material: Basalt rubble
    - Haul distance: 79 miles (127 kilometers)
    - Quantity: 9,165 cubic yards (7,012 cubic meters

The mill site at Green River before remediation.

The mill site with disposal cell at Green River after remediation.

- Type B
  - Source: Fremont Junction, UT
  - Type material: Basalt rubble
  - Haul distance: 79 miles (127 kilometers)
  - Quantity: 15,462 cubic yards (11,830 cubic meters

OTHER INFORMATION

- Vicinity properties cleaned up: 17
- VP material volume: 45,016 cubic yards (34,442 cubic meters)
- Citizen advisory committee: None
- Public participation issues: Ground water protection. Usable buildings were not demolished at request of city to encourage local business to use the buildings.

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	1,731
Env. Health & Safety/NEPA	936
RA Design	1,305
Site Acquisition	5
RA Field Management	1,551
Site Preparation	1,557
Tailings Handling	1,376
Cover Material	817
Erosion Protection	1,006
Site Restoration	1,600
All Other Construction Costs	926
VP Design	220
VP Construction	1,259
Surveillance & Maintenance	906
Site Specific Total	$15,195

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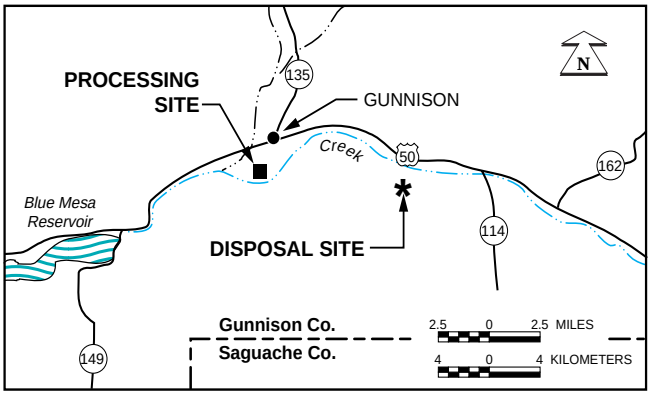
Gunnison, Colorado

Site Description

The former Gunnison mill and tailings site is a 61-acre (24.7 hectares) tract located southwest of the city of Gunnison and adjacent to the Gunnison airport. Before remedial action began, RRM covered an area of about 39 acres (15.8 hectares). A disposal cell to



isolate the RRM in accordance with EPA standards was constructed on BLM land approximately seven miles east of Gunnison.

Site History

The former uranium processing mill operated from 1958 to 1962, first by the Gunnison Mining Company, then by Kermac Nuclear Fuels Corporation, a subsidiary of Kerr-McGee Oil Industries. The property passed through several owners until 1990 when the State of Colorado claimed ownership.

Remedial Action

Phase I remedial action began in September 1991 with demolition of the mill buildings. Phase II remediation began June 1992 and was completed in December 1995.

The cleaned up areas at the former processing site were backfilled with uncontaminated soil to an elevation compatible with the surrounding terrain, recontoured to promote surface drainage and revegetated as necessary.

Site Information

The site, public land formerly administered by the BLM, was transferred to DOE on June 15, 1992.

SCHEDULE MILESTONES

- (EA) FONSI publication date: February 1992
- Final RAP: December 1993
- Date contractor mobilized: May 1992
- Date contractor demobilized: December 1995
- Date mill site certified: September 1997
- Date disposal cell licensed: September 1997

CELL STATISTICS

- Method of containment: Relocate to the Chance Gulch disposal site
- Volume of contaminated material handled: 742,465 cubic yards (568,068 cubic meters)
- Volume of contaminated material in cell: 742,465 cubic yards (568,068 cubic meters)
- Volume of uncontaminated material (fill) handled at processing site: 680,210 cubic yards (520,436 cubic meters)
- Average tailings radioactivity: 314 pCi/g, Ra-226
- Total radioactivity in cell: 175 Curies, Ra-226
- Cell dimensions: The 29-acre (11.7 hectares) disposal cell is roughly rectangular in shape, rises some 55 feet (17 meters)above the surrounding terrain, and is 1,300 feet (395 meters) long and 1,050 feet (320 meters) wide. It is located on a slope and is constructed partially below grade. It is approximately 60 feet (18 meters) deep from its highest to its lowest point.
- Cell design: The disposal cell is capped with a 9-foot (2.7 meters)-thick, multilayered cover. A 1.5 foot (0.46 meters)-thick radon/infiltration barrier, constructed of clayey soil amended with bentonite, was placed over the contaminated materials. A sandy gravel layer was placed on the radon/infiltration barrier, which provides a capillary break and promotes drainage of infiltrating water away from the radon barrier. A 6-foot, 1-inch (1.85 meters)-thick layer of compacted soil was placed next to protect the radon/infiltration barrier from freezing and thawing cycles.

The third layer is 6 inches (0.15 meters) of coarse-grained bedding material which prevents erosion of the frost barrier. The top layer provides erosion protection from wind and water. It consists of 6 (0.15 meters) inches of riprap on the topslopes and

12 inches (0.3 meters) of riprap on the sideslopes. The maximum grade is 2.5 percent on the topslopes and 33 percent on the sideslopes.

CONSTRUCTION STATISTICS

- Truck miles driven: 587,555 (947,670 kilometers)
- Estimated risk reduction: 6.5 deaths prevented
- Peak employment level: 134
- Safety record
  - Total Recordable Rate - 1.4
  - Total Lost Worksday Rate - 0.0
- Remediation subcontractor: Ames Construction, Inc.
- Contaminated Material:
  - Equipment & method: Highway truck and dump trailer
  - Haul distance: 7 miles (11 kilometers)
- Cover Material:
  - Radon Barrier
    - Source: Six Mile Lane Borrow Area

The mill site at Gunnison before remediation.

The mill site at Gunnison after remediation.

-- Type material: Silty clay sand with bentonite added
-- Haul distance: 1 mile (1.6 kilometers)
-- Equipment & method: Highway truck and belly dump trailer
-- Quantity: 41,078 cubic yards (31,429 cubic meters)
-- Bentonite %: 5%

- Frost Barrier
-- Source: Six Mile Lane Borrow Area
-- Type material: Clayey silty sand
-- Haul distance: 1 mile (1.6 kilometers)
-- Equipment & method: Highway truck and belly dump trailer
-- Quantity: 187,701 cubic yards (143,612 cubic meters)

• Erosion Protection:
- Bedding
-- Source: Chance Gulch Borrow
-- Type material: Crushed graywacke or meta-sedimentary
-- Haul distance: 2 miles (3.2 kilometers)
-- Quantity: 22,450 cubic yards (17,177 cubic meters)
-- Gradation: 3 inches (7.6 centimeters) minus

- Type A
-- Source: Chance Gulch Borrow
-- Type material: Crushed graywacke or meta-sedimentary
-- Haul distance: 2 miles (3.2 kilometers)
-- Quantity: 19,503 cubic yards (14,922 cubic meters)
-- Gradation: 4 inches (10.2 centimeters) x 1 inch (2.5 centimeters)

- Type B
-- Source: Chance Gulch Borrow
-- Type material: Crushed graywacke or meta-sedimentary
-- Haul distance: 2 miles (3.2 kilometers)
-- Quantity: 12,713 cubic yards (9,727 cubic meters)
-- Gradation: 8 inches (20.3 centimeters) x 2 inches (5.1 centimeters)

- Type C
-- Source: Chance Gulch Borrow
-- Type material: Crushed graywacke or meta-sedimentary
-- Haul distance: 2 miles (3.2 kilometers)
-- Quantity: 14,866 cubic yards (11,374 cubic meters)
-- Gradation: 12 inches (30.5 centimeters) x 4 inches (10.2 centimeters)

- Type D
-- Source: Chance Gulch Borrow
-- Type material: Crushed graywacke or meta-sedimentary
-- Haul distance: 2 miles (3.2 kilometers)
-- Quantity: 275 cubic yards (210 cubic meters)
-- Gradation: 20 inches (50.8 centimeters) x 6 inches (15.2 centimeters)

OTHER INFORMATION

• Vicinity properties cleaned up: 12
• VP material handled: 14,188 cubic yards (10,855 cubic meters)
• Citizen advisory committee: None
• Public participation issues: Disposal site selection. Haul routes and impacts on wildlife (antelope and sage grouse) and grazing rights. Construction of waterline to nearby subdivision.

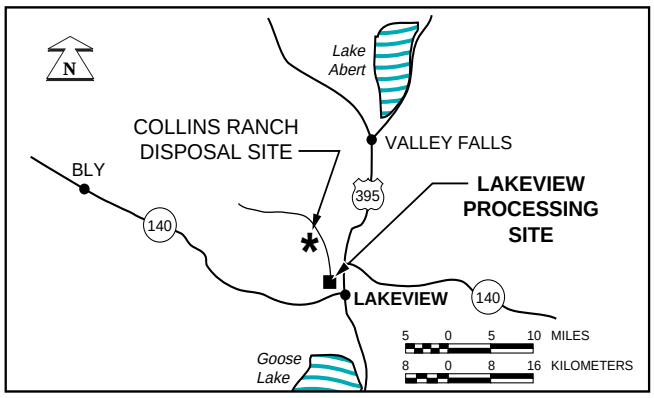
MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	7,051
Env. Health & Safety/NEPA	1,718
RA Design	5,441
Site Acquisition	277
RA Field Management	8,620
Site Preparation	3,986
Tailings Handling	4,668
Cover Material	493
Erosion Protection	698
Site Restoration	1,636
All Other Construction Costs	4,443
VP Design	135
VP Construction	639
Surveillance & Maintenance	542
Site Specific Total	$40,347

The Gunnison disposal cell at Chance Gulch.

Lakeview, Oregon

Site Description

The former Lakeview mill and tailings site is located in south-central Oregon, approximately 16 miles (26 kilometers) north of the California-Oregon border and 96 miles (155 kilometers) east of Klamath Falls, OR. The tailings pile covered about 30 acres (12 hectares) of the 258-acre (104 hectares) site. Six evaporation ponds occupied another 64 acres (26 hectares).



Site History

The Lakeview uranium mill was built in 1958 and was operated by the Lakeview Mining Company. Uranium ore was processed at the mill from 1958-1961. In 1968 the mill site was acquired by the Atlantic Richfield Company, which began a cleanup operation in 1974. By 1977, the mill buildings and the surrounding areas had been decontaminated to meet state regulations then in effect. The mill was sold in 1978 to the Precision Pine Company, which used the site as a lumber mill and a stockpile facility for sawdust and scrap waste. Various private landowners and Lake County now own the site.

Remedial Action

Remedial action of the Lakeview site began in June 1986. The remedial action involved relocating approximately 943,000 cubic yards (721,500 cubic meters) of RRM to the Collins Ranch disposal site, located approximately seven miles (11 kilometers) northwest of Lakeview. Relocation was required because possible seismic and geothermal activity in the area precluded stabilizing the RRM in-place at the Lakeview site. Remedial action was completed in October 1989. In September 1995, NRC licensed the site and DOE transferred responsibility for the site to its Grand Junction Office in Grand Junction, CO for long-term surveillance.

Site Information

Lakeview's Collins Ranch disposal site was acquired by the State of Oregon in 1986 through a civil action suit (Energy Facility Siting Council vs. John Collins). It included a 40-acre site (16.2 hectares), perpetual site access across the Collins Ranch and unlimited access to all off-site groundwater monitoring wells.

SCHEDULE MILESTONES

- (EA) FONSI: December 1985
- Date contractor mobilized: June 1986
- Date contractor demobilized: October 1989
- Final RAP: September 1993
- Date mill site certified: September 1993
- Date disposal cell licensed: September 1995

CELL STATISTICS

- Method of containment: Relocation to Collins Ranch disposal site
- Volume of contaminated material handled: 943,630 cubic yards (721,980 cubic meters)
- Volume of contaminated material in cell: 943,630 cubic yards (721,980 cubic meters)
- Volume of uncontaminated material (fill) handled at processing site: 79,000 cubic yards (60,400 cubic meters)
- Average tailings radioactivity: 112 pCi/g, Ra-266
- Total radioactivity in cell: 42 Curies, Ra-226
- Cell dimensions: The disposal cell is roughly semi-circular in shape, covers some 16 acres (6.5 hectares) and is constructed partially belowgrade against the southwest slope of a hill. It is approximately 1,050 feet long (320 meters) by 800 feet (240 meters) wide. It rises some 40 feet (12 meters) above the surrounding terrain and is approximately 75 feet (23 meters) deep from its highest to its lowest point.
- Cell design: The cell is capped by a 3-foot (0.9 meters)-thick multilayered cover. The contaminated material is covered with a 1.5-foot (0.46 meters) radon/infiltration barrier layer made of compacted, fine-grained soil. A 6-inch (0.15 meters) bedding layer was placed next to facilitate drainage. The final erosion protection layer consisted of a 1-foot (0.3

meters)-thick rock (Type A riprap) and soil with native grass on topslopes and 12 inches (0.3 meters) of rock (Type B riprap) on the sides). Topslopes feature a two to four percent grade; sideslopes were graded to 20 percent.

CONSTRUCTION STATISTICS

- Truck miles driven: 412,480 (665,290 kilometers)
- Estimated risk reduction: 0.027 deaths prevented
- Peak employment level:
- Safety record:
  - Total Recordable Rate - 3.0
  - Total Lost Workday Rate - 1.5
- Remediation subcontractor: Industrial Constructors Corporation
- Contaminated Material:
  - Equipment & method: Highway truck and belly dump trailer
  - Haul distance: 7 miles (11 kilometers)
- Cover Material:
  - Radon barrier:
    - Source: Borrow
    - Type material: Clay
    - Haul distance: 1 mile (1.6 kilometers)
    - Equipment & method: Highway truck and belly dump trailer

The mill site at Lakeview before remediation.

The mill site at Lakeview after remediation.

-- Quantity: 33,388 cubic yards (25,546 cubic meters)
-- Bentonite %: None

• Erosion Protection:
- Bedding:
-- Source: Pepperling Quarry and Shears Quarry
-- Type material: Crushed
-- Haul distance: 12 miles (19 kilometers)
-- Quantity: 13,012 cubic yards (9,956 cubic meters)
-- Gradation: 3 inches (7.6 centimeters) minus

- Type A:
-- Source: Pepperling Quarry
-- Type material: Crushed basalt
-- Haul distance: 12 miles (19 kilometers)
-- Quantity: 12,058 cubic yards (9226 cubic meters)
-- Gradation: 4 inches (10.2 centimeters) minus

- Type B:
-- Source: Pepperling Quarry and Shears Quarry
-- Type material: Crushed basalt
-- Haul distance: 12 miles (19 kilometers)
-- Quantity: 11,875 cubic yards (9,086 cubic meters)
-- Gradation: 5 inches (12.7 centimeters) minus

- Type C:
-- Source: Pepperling Quarry and Shears Quarry
-- Type material: Crushed basalt
-- Haul distance: 12 miles (19 kilometers)
-- Quantity: 2,983 cubic yards (2,282 cubic meters)
-- Gradation: 12 inches (30.5 centimeters) minus

- Type D:
-- Source: Pepperling Quarry and Shears Quarry
-- Type material: Crushed basalt
-- Haul distance: 12 miles (19 kilometers)
-- Quantity: 6,173 cubic yards (4,723 cubic meters)
-- Gradation: 38 inches (96.5 centimeters) minus

OTHER INFORMATION

• Vicinity properties cleaned up: 8
• VP material handled: 15,358 cubic yards (11,751 cubic meters)
• Citizen advisory committee: None
• Public participation issues: Additional excavation to remove arsenic contamination.

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	2,294
Env. Health & Safety/NEPA	1,146
RA Design	1,483
Site Acquisition	212
RA Field Management	3,812
Site Preparation	2,292
Tailings Handling	5,387
Cover Material	330
Erosion Protection	585
Site Restoration	2,725
All Other Construction Costs	3,129
VP Design	109
VP Construction	368
Surveillance & Maintenance	699
Site Specific Total	$24,571

The Lakeview disposal cell at Collins Ranch.

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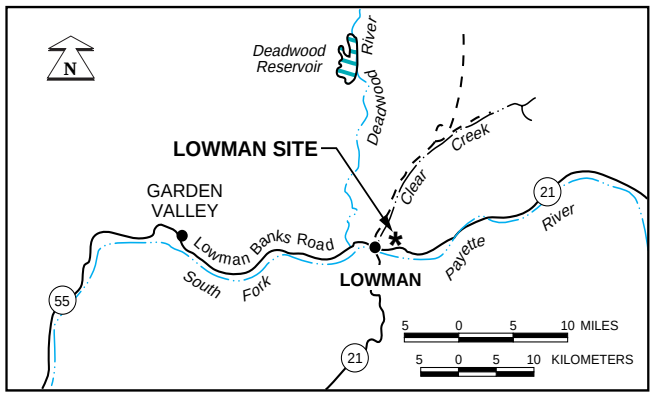
Lowman, Idaho

Site Description

The former Lowman mill and tailings site, which covers 37 acres (15 hectares), is located approximately 75 miles (120 kilometers) northeast of Boise, ID in the Boise National Forest. It is one-half mile (.08 kilometers) northeast of the town of Lowman. When the remedial action project started, little remained of the mill structure except foundations and debris. Piles of radioactive tailings were scattered over a five-acre (2 hectares) parcel of the site. Other contaminated



areas on the site included the mill yard, ore storage area, evaporation ponds, and windborne and waterborne contaminated material. The total amount of RRM on the site was more than 154,000 cubic yards 117,800 cubic meters).

Site History

Porter Brothers Corporation of Boise was the original owner of the site, operating the mill from 1955 until 1960. During that time, approximately 200,000 tons (181,000 metric tons) of dredge product obtained from Bear Valley, 20 miles (32 kilometers) north of Lowman, were processed. The process used was mechanical rather than chemical. Following mill shutdown, the site was purchased by Velsicol Chemical Corporation, formerly known as the Michigan Chemical Corporation. The DOE now owns the site.

Remedial Action

The Lowman remedial action program involved stabilizing the RRM on site by encapsulating it in an engineered disposal cell. Surface remedial action began in April 1991 and was completed in June 1992. The NRC licensed the Lowman site in September 1994 and, in October 1994, DOE transferred responsibility for the site to its Grand Junction Office in Grand Junction, CO for long-term-surveillance.

Site Information

The State of Idaho acquired the larger portion of the site, 37 acres (15 hectares), from NWI Land Management Corp. A second, 4.3-acre (1.7 hectares) parcel was purchased from the U.S. Forest Service. Subsurface mineral rights were acquired via a jurisdiction transfer from the BLM.

SCHEDULE MILESTONES

- (EA) FONSI: March 1991
- Date contractor mobilized: April 1991
- Final RAP: 1991
- Date contractor demobilized: June 1992
- Date mill site certified: September 1994
- Date disposal cell licensed: September 1994

CELL STATISTICS

- Method of containment: Stabilize in place
- Volume of contaminated material handled: 154,024 cubic yards (117,845 cubic meters)
- Volume of contaminated material in cell: 154,024 cubic yards (117,845 cubic meters)
- Average tailings radioactivity: 157 pCi/g, Ra-226
- Total radioactivity in cell: 12 Curies, Ra-226
- Cell dimensions: The disposal cell is roughly semicircular in shape and covers 8.2 acres (3.3 hectares). It is approximately 950 feet (290 meters) long by 480 feet (145 meters) wide, and is 30 feet (9.1 meters) deep from its highest to its lowest point.
- Cell design: The cell is capped with a 3-foot (0.9 meters)-thick multilayered cover. Contaminated materials are encapsulated by a 1.5-foot (0.46 meters) radon barrier of compacted earth. This is covered with six inches (0.15 meters) of sand and gravel bedding material and a 12-inch (0.3 meters) erosion protection layer of rock. Its topslope grade is 10 percent; sideslopes are graded to 20 percent.

CONSTRUCTION STATISTICS

- Truck miles driven: 112,445 (181,363 kilometers)
- Estimated risk reduction: 0.013 deaths prevented
- Peak employment level: 89
- Safety record:
  - Total Recordable Rate - 0.0

- Total Lost Workday Rate - 0.0
- Remediation subcontractor: Industrial Constructors Corp.
- Contaminated Material:
  - Equipment and method: Scraper
- Cover Material:
  - Radon Barrier
    - Source: Borrow
    - Type material: Clay
    - Haul distance: 1 mile (1.6 kilometers)
    - Equipment and method: Scraper
    - Quantity: 17,929 cubic yards (13,718 cubic meters)
    - Bentonite %: None
- Erosion Protection:
  - Bedding
    - Type material: Crushed basalt
    - Quantity: 6,694 cubic yards (5,122 cubic meters)
  - Type A (classified as small rock)
    - Type material: Crushed basalt
    - Quantity: 15,443 cubic yards (11,816 cubic meters)
    - Gradation: 10 inches (25.4 centimeters) minus
  - Type B (classified as large rock)
    - Type material: Crushed basalt and granite
    - Quantity: 8,169 cubic yards (6,250 cubic meters)
    - Gradation: 36 inches (91.4 centimeters) minus

The mill site at Lowman before remediation.

The mill site at Lowman after remediation.

OTHER INFORMATION

- Vicinity properties cleaned up: 38
- VP material handled: 28,160 cubic yards (21,546 cubic meters)
- Citizen advisory committee: None
- Public participation issues: None

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	1,497
Env. Health & Safety/NEPA	811
RA Design	765
Site Acquisition	58
RA Field Management	1,214
Site Preparation	99
Tailings Handling	491
Cover Material	81
Erosion Protection	1,325
Site Restoration	191
All Other Construction Costs	636
VP Design	593
VP Construction	3,519
Surveillance & Maintenance	218
Site Specific Total	$11,498

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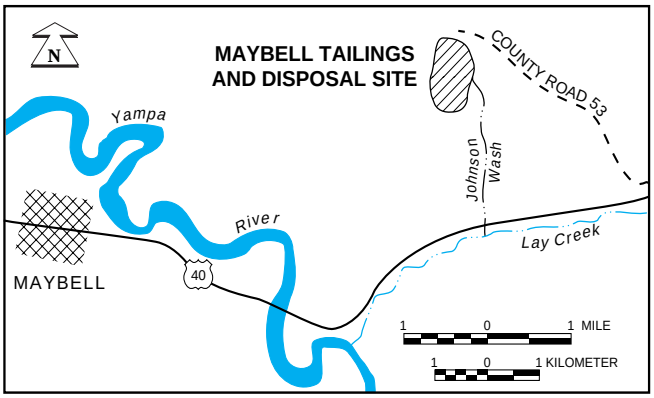
Maybell, Colorado

Site Description

The Maybell mill and tailings site is approximately 25 miles (40 kilometers) west of the town of Craig in Moffat County in northwestern Colorado. The site is five miles (8 kilometers) northeast of the town of Maybell and is surrounded by several open pit mines. The site covers 110 acres (44.5 hectares). An additional 182 acres (73.7 hectares) of land contained RRM deposited by wind or water erosion from the site.



Site History

The Trace Elements Corporation established the processing mill near Maybell in 1955-56, and Union Carbide Corporation assumed control of the site in 1957. Umetco Minerals Corporation, a wholly owned subsidiary of the Union Carbide Corporation, operated the site until 1964, processing approximately 2.6 million tons (2.4 million metric tons) of uranium ore obtained from nearby open pit mines. All uranium concentrate produced was sold to the U.S. Atomic Energy Commission. After the mill shut down in November 1964, Umetco dismantled it and, in 1971, started stabilizing the tailings in accordance with State of Colorado regulations. Part of the site is on federal land and the remainder is privately owned.

Remedial Action

The Maybell surface remedial action project began in May 1995 and was completed in September 1998. It involved stabilization of the RRM in its present location in an engineered disposal cell. Other RRM (e.g., from wind and water erosion) was also placed in the disposal cell. Cleaned up areas at the site were backfilled with uncontaminated soil to an elevation compatible with the surrounding terrain, recontoured to promote surface drainage and revegetated as necessary. The disposal cell was covered with a radon barrier and a rock erosion protection layer.

Site Information

The larger portion of the site, formerly administered by the BLM, was transferred to DOE on April 13, 1995. The second portion, consisting of two privately owned properties, was acquired by the state and transferred to the federal government in 1997.

SCHEDULE MILESTONES

- (EA) FONSI: January 1995
- Date contractor mobilized: May 1995
- Final RAP: February 1996
- Date contractor demobilized: October 1998
- Date mill site is to be certified: June 1999
- Date disposal cell is to be licensed: June 1999

CELL STATISTICS

- Method of containment: Stabilize in place
- Volume of contaminated material handled: 1,003,716 cubic yards (76,795 cubic meters)
- Volume of contaminated material in cell: 4,100,000 cubic yards (3,140,000 cubic meters)
- Volume of uncontaminated material handled: 918,000 cubic yards (702,300 cubic meters)
- Average tailings radioactivity: 200 pCi/g, Ra-266
- Total radioactivity in cell: 455 Curies, Ra-226
- Cell dimensions: The cell covers approximately 66 acres (26.7 hectares) and rises some 30 feet (9 meters) above the surrounding terrain. It is approximately 75 feet (23 meters) deep from its highest to its lowest point. Its shape is roughly triangular, and is 2,600 feet (790 meters) long and 1,700 feet (520 meters) wide.
- Cell design: The disposal cell features a 7-foot (2.1 meters)-thick multiple-component cover. A 1.5-foot (0.46 meters)-thick radon/infiltration barrier, comprised of bentonite-amended soil, was placed on top of the contaminated materials. A 4-foot (1.22 meters)-thick layer of compacted soil was then placed to protect the radon/infiltration barrier from the adverse effects of freeze-thaw cycles. The third layer is six inches (0.15 meters) of coarse-grained bedding material which is used to prevent erosion

of underlying soil, and to promote drainage of water away from the radon/infiltration barrier. The top layer is an 8- to 12-inch (0.2 to 0.3 meters)-thick layer of rock (Type A riprap) to prevent wind and water erosion.

The cell's top slopes to the west at a grade of three percent. Runoff from the topslope enters a rock-lined ditch adjacent to the cell. The sideslopes of the cell are at a 20 percent grade and are protected by riprap aprons on the south and east sides. On the north and west sides of the cell, the sideslopes are part of the main ditch.

CONSTRUCTION STATISTICS

- Truck miles driven: 30,129 (48,595 kilometers)
- Estimated risk reduction: 0.003 deaths prevented
- Peak employment levels: 65
- Safety record:
  - Total Recordable Rate - 2.5
  - Total Lost Workday Rate - 1.0
- Remediation subcontractor: Nielsons, Inc.
- Contaminated Material
  - Equipment and method: Scrapers
  - Haul distance: 1 mile (1.6 kilometers)
- Cover Material:
  - Radon Barrier
    - Source: Borrow
    - Type material: Sandy clay with bentonite
    - Haul distance: 2,000 feet (610 meters)
    - Equipment and method: Scrapers
    - Quantity: 181,380 cubic yards (138,776 cubic meters)
    - Bentonite %: 7%
  - Frost Barrier
    - Source: Borrow (on-site)
    - Type material: Stockpiled overburden from mining
    - Haul distance: 2,000 feet (610 meters)
    - Quantity: 426,000 cubic yards (326,000 cubic meters)
- Erosion Protection:
  - Bedding
    - Source: Hertzog Quarry
    - Type material: Alluvial
    - Haul distance: 7 miles (11 kilometers)
    - Quantity: 76,300 cubic yards (58,300 cubic meters)
    - Gradation: 3 inches (7.6 centimeters) minus
  - Type A
    - Source: Hertzog Quarry
    - Type material: Alluvial
    - Haul distance: 7 miles (11 kilometers)
    - Quantity: 59,500 cubic yards (45,500 cubic meters)
    - Gradation: 3 inches (7.6 centimeters) minus
  - Type B
    - Source: Juniper Mtn. Quarry
    - Type material: Crushed limestone
    - Haul distance: 15 miles (24 kilometers)
    - Quantity: 50,000 cubic yards (38,200 cubic meters)
    - Gradation: 8 inches (20.3 centimeters) minus
  - Type C
    - Source: Juniper Mtn. Quarry
    - Type material: Crushed limestone
    - Haul distance: 15 miles (24 kilometers)
    - Quantity: 8,900 cubic yards (6,800 cubic meters)
    - Gradation: 8 inches (20.3 centimeters) minus
  - Type D
    - Source: Juniper Mtn. Quarry
    - Type material: Crushed limestone
    - Haul distance: 15 miles (24 kilometers)
    - Quantity: 61,300 cubic yards (46,900 cubic meters)
    - Gradation: 18 inches (45.7 centimeters) minus
  - Type E
    - Source: Juniper Mtn. Quarry
    - Type material: Crushed limestone
    - Haul distance: 15 miles (24 kilometers)
    - Quantity: 14,460 cubic yards (11,060 cubic meters)
    - Gradation: 42 inches (106.7 centimeters) minus

OTHER INFORMATION:

- Vicinity properties cleaned up: 13
- VP material handled: 3,556 cubic yards (2,721 cubic meters)
- Citizen advisory committee: None
- Public participation issues: None

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	3,100
Env. Health & Safety/NEPA	1,183
RA Design	3,137
Site Acquisition	30
RA Field Management	8,169
Site Preparation	3,998
Tailings Handling	2,533
Cover Material	7,072
Erosion Protection	6,855
Site Restoration	2,443
All Other Construction Costs	3,599
VP Design	327
VP Construction	227
Surveillance & Maintenance	93
Site Specific Total	$42,766

The mill site at Maybell before remediation.

The mill site with disposal cell at Maybell after remediation.

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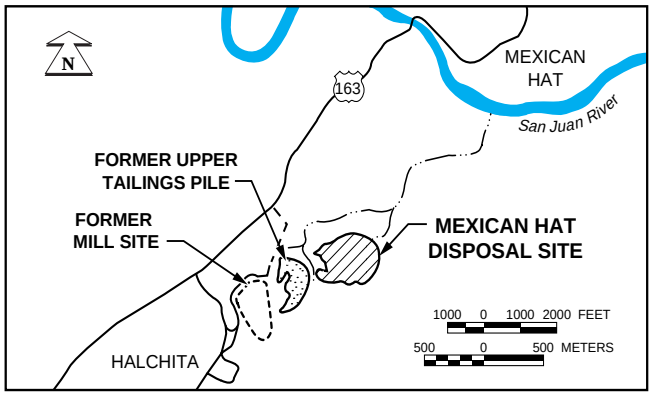
Mexican Hat, Utah

Site Description

The former Mexican Hat mill and tailings site covered approximately 235 acres (95.1 hectares) and is located on Navajo Nation land at Halchita, UT about 1.5 miles (2.4 kilometers) southwest of Mexican Hat, UT.

Before remedial action, there were two adjacent tailings piles covering 25 and 48 acres (10.1 and 19.4 hectares) each. The site also contained seven mill buildings and associated debris, a concrete pad, contaminated soil, and windblown material.



Site History

Texas-Zinc Minerals Corporation built the Mexican Hat plant in 1957 and operated it under a lease with the Navajo Nation until 1963, when it was sold to Atlas Corporation. Atlas operated the mill for two years and shut it down in 1965. When the Atlas lease expired in 1970, control of the site reverted to the Navajo Nation.

Remedial Action

Approximately 2.5 million cubic yards (1.9 million cubic meters) of RRM from the two tailings piles were consolidated in place at the bottom of what is now the Mexican Hat disposal cell. Approximately 928,000 cubic yards (710,000 cubic meters) of RRM was also moved from the Monument Valley, AZ site to the cell. Altogether, over three million cubic yards (2.3 million cubic meters) of RRM were consolidated in the 50-foot (15.2 meters)-high cell. Remedial action (Phase I) at Mexican Hat began in July 1987, and was completed in October. Phase II was halted due to budget constraints in February 1990. The project was restarted in September 1992 and surface remediation was completed in February 1995.

Site Information

Title to the disposal site was retained by the Navajo Nation. A Custodial Access Agreement was executed on August 12, 1996, conveying to the federal government title to the RRM stabilized within the disposal cell.

SCHEDULE MILESTONES

- (EA) FONSI publication date: October 1987
- Date contractor mobilized: October 1992
- Date contractor demobilized: January 1995
- Final RAP: May 1995
- Date mill site certified: September 1997
- Date disposal cell licensed: September 1997

CELL STATISTICS

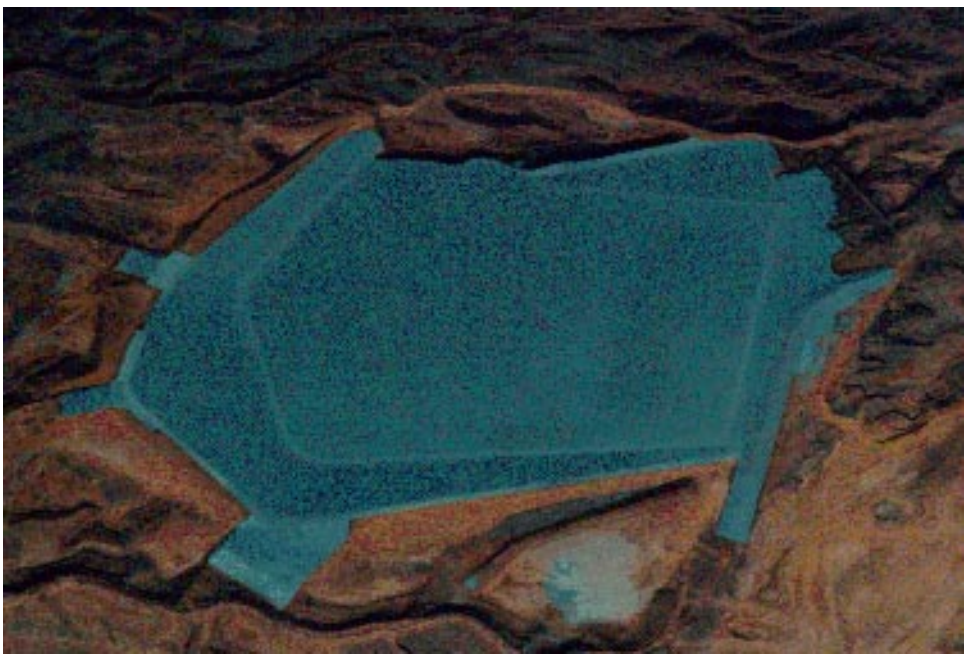
- Method of containment: Stabilize on-site along with RRM from Monument Valley site
- Volume of contaminated material handled: 2,072,864 cubic yards (1,585,971 cubic meters)
- Volume of contaminated material in cell: 3,483,248 cubic yards (2,665,071 cubic meters)[includes 928,496 cubic yards (710,402 cubic meters) from the Monument Valley, AZ, site]
- Average tailings radioactivity: 667 pCi/g, Ra-226
- Total radioactivity in cell: 1,800 Curies, Ra-226
- Cell dimensions: The above-ground disposal cell is roughly pentagonal in shape and covers approximately 68 acres (27 hectares). It abuts a steep ridge to the south and rises to a height of 50 feet (15 meters) above the surrounding terrain to the north, east and west. The cell is approximately 2,700 feet (820 meters) long and 1,700 feet (520 meters) wide. It is approximately 50 feet (15 meters) deep from its highest to its lowest point.
- Cell design: The cell is capped with a 3.5-foot (1.1 meter)-thick, multi-layered cover. Contaminated materials were covered with a 2-foot (0.61 meters) radon barrier of compacted silty sand amended with 10 percent bentonite clay. This was covered by a 6-inch (0.15 meters) bedding layer of coarse sand and

gravel. The top erosion protection layer consisted of eight inches (0.2 meters) of rock (Type A riprap) on the cell's top and 12 inches (0.3 meters) of rock (Type B riprap) on the sideslopes and aprons. The top of the cell has a two percent grade to promote drainage; sideslopes are graded to 20 percent.

CONSTRUCTION STATISTICS

- Haul distance: 17 miles (27 kilometers) [haul distance for Monument Valley RRM]
- Truck miles driven: 2,814,761 (4,539,937 kilometers) [combined mileage for Mexican Hat and Monument Valley sites]
- Estimated risk reduction: 1.3 deaths prevented
- Peak employment level: 170 (joint Mexican Hat/ Monument Valley workforce)
- Safety record: (Rate combined for Mexican Hat/ Monument Valley sites)
  - Total Recordable Rate - 1.2
  - Total Lost Workday Rate - 0.8
- Remediation subcontractor: Dine' Bi Ghan/Industrial Joint Venture
- Contaminated Material:
  - Method of containment:
    -- Mexican Hat - Stabilize in place (upper pile moved and placed on lower pile)

The mill site at Mexican Hat before remediation.



The mill site and disposall cell at Mexican Hat after remediation.

-- Monument Valley - Relocated to Mexican Hat
- Equipment and method:
-- Mexican Hat - Scrapers
-- Monument Valley - Highway truck and tandem belly dump trailers
- Haul distance:
-- Mexican Hat - 200 to 2,000 feet (60 to 600 meters)
-- Monument Valley - 17 miles (27 kilometers)

• Cover Material:
- Radon Barrier
-- Source: RB4 borrow area
-- Type material: Sand amended with bentonite
-- Haul distance: 5 miles (8 kilometers)
-- Equipment and method: Highway truck and tandem belly dump trailers
-- Quantity: 222,203 cubic yards (170,010 cubic meters)
-- Bentonite %: 10%
- Frost Barrier: None

• Erosion Protection:
- Bedding
-- Source: Bluff Quarry Borrow Area
-- Type material: River run gravels
-- Haul distance: 30 miles (48 kilometers)
-- Quantity: 59,992 cubic yards (45,901 cubic meters)
-- Gradation: 3 inches (7.6 centimeters) minus

- Type A
-- Source: Bluff Quarry Borrow Area
-- Type material: River run gravels
-- Haul distance: 30 miles (48 kilometers)
-- Quantity: 61,181 cubic yards (46,810 cubic meters)
-- Gradation: 3 inches (7.6 centimeters) minus
- Type B
-- Source: Bluff Quarry Borrow Area
-- Type material: River run gravels
-- Haul distance: 30 miles (48 kilometers)
-- Quantity: 20,760 cubic yards (15,884 cubic meters)
-- Gradation: 8 inches (20.3 centimeters) minus
- Type B1
-- Source: Bluff Quarry Borrow Area
-- Type material: River run gravels
-- Haul distance: 30 miles (48 kilometers)
-- Quantity: 25,704 cubic yards (19,666 cubic meters)
-- Gradation: 5 inches (12.7 centimeters) minus
- Type B Angular
-- Source: Holiday Pit
-- Type material: Limestone
-- Haul distance: 25 miles (40 kilometers)
-- Quantity: 4,276 cubic yards (3,272 cubic meters)
-- Gradation: 8 inches (20.3 centimeters) minus
- Type C
-- Source: Holiday Pit
-- Type material: Limestone
-- Haul distance: 25 miles (40 kilometers)
-- Quantity: 22,760 cubic yards (17,414 cubic meters)
-- Gradation: 12 inches (30.5 centimeters) minus

OTHER INFORMATION

• Vicinity properties cleaned up: 11
• VP material volume: 11,192 cubic yards (8,563 cubic meters)
• Citizen advisory committee: None
• Public participation issues: Haul road safety

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	1,751
Env. Health & Safety/NEPA	1,033
RA Design	2,892
Site Acquisition	—
RA Field Management	11,934
Site Preparation	6,069
Tailings Handling	3,121
Cover Material	4,384
Erosion Protection	3,755
Site Restoration	907
All Other Construction Costs	6,390
VP Design	151
VP Construction	1,408
Surveillance & Maintenance	195
Site Specific Total	$43,990

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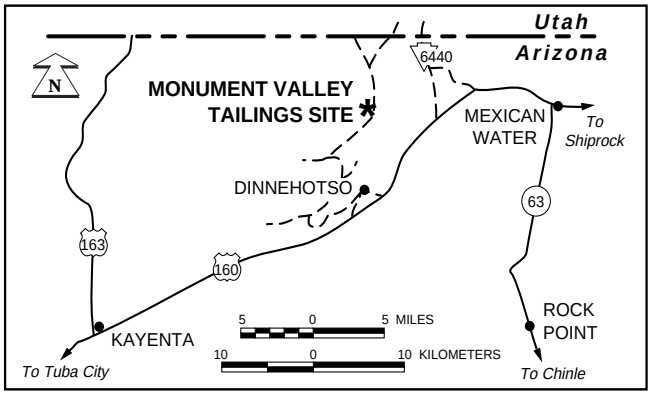
Monument Valley, Arizona

Site Description

The former Monument Valley mill and tailings site is on Navajo Nation land 13 miles (21 kilometers) east of Monument Valley Tribal Park in Arizona. It is located 17 miles (27 kilometers) south of the Mexican Hat, Utah, site and is about five miles (8 kilometers) south of the Utah-Arizona border. The site covered approximately 101 acres (40.9 hectares); tailings were



located in two piles covering about 30 acres (12.1 hectares). The older heap-leach pile covered about 10 acres (4 hectares). The newer tailings pile was cone-shaped, about 55 feet (17 meters) high, covered about 20 acres (8.1 hectares) and contained over two-thirds of the tailings at the site. The site also contained the old mill building foundations, contaminated soil, and windblown material.

Site History

The mill was constructed in 1955 and operated through 1968 by Vanadium Corporation of America and its successor, Foote Mineral Company. Before and during the milling operations, the site was leased from the Navajo Nation. When the lease expired in 1968, control of the site reverted to the Navajo Nation.

Remedial Action

The Monument Valley remedial action project involved the relocation of 928,496 cubic yards (710,402 cubic meters) of RRM from the existing site to the Mexican Hat disposal cell in Halchita, Utah, 17 miles (27 kilometers) north along Indian Service Route 6440.

Surface remediation work began in May 1989, but was halted due to budget constraints in February 1990. Work was restarted in September 1992 and was completed in March 1994.

Site Information

Title to the site was retained by the Navajo Nation.

SCHEDULE MILESTONES

- (EA) FONSI: May 1989
- Date contractor mobilized: October 1992
- Date contractor demobilized: January 1995
- Final RAP: May 1995
- Date site certified: September 1997
- Date disposal cell licensed: Not applicable

CELL STATISTICS

- Method of containment: Relocated to the Mexican Hat disposal cell
- Volume of contaminated material handled: 928,496 cubic yards (710,402 cubic meters)
- Volume of contaminated material in cell: Not applicable
- Average tailings radioactivity: 54 pCi/g, Ra-226
- Total radioactivity in cell: Not applicable
- Cell dimensions: Not applicable
- Cover design: Not applicable
- Source and type of cover material: Not applicable

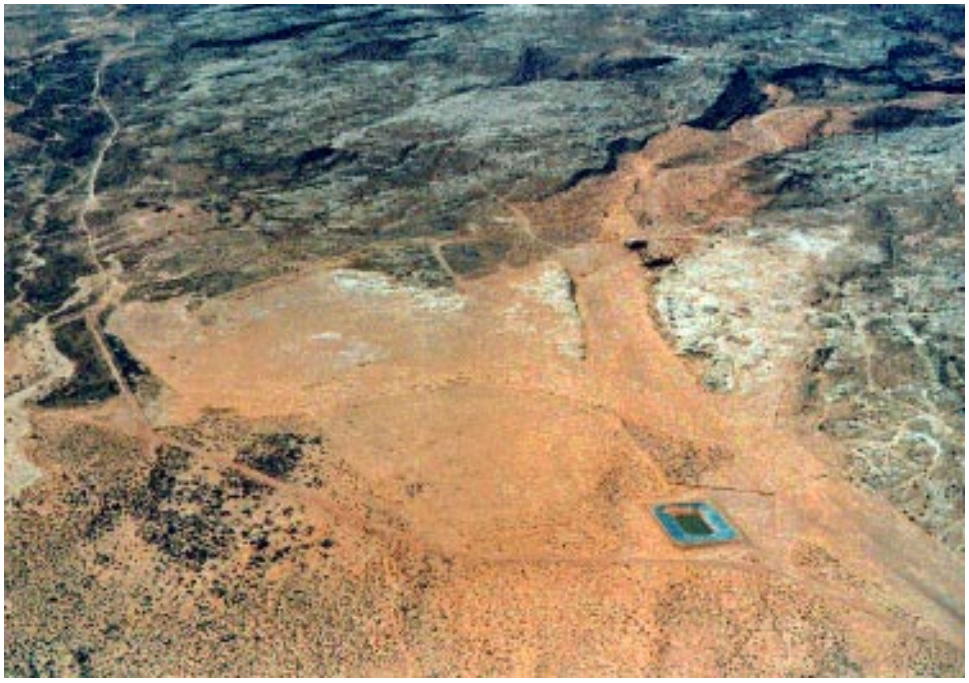
CONSTRUCTION STATISTICS

- Haul distance: 17 miles (27 kilometers)
- Estimated risk reduction: 0.016 deaths prevented
- Peak employment level: 170 (joint Mexican Hat/ Monument Valley workforce)
- Safety record: (rate combined for Mexican Hat/ Monument Valley sites)
  - Total Recordable Rate - 1.2
  - Total Lost Workday Rate - 0.8
- Remediation subcontractor: Dine' Bi Ghan/Industrial Joint Venture

OTHER INFORMATION

- Vicinity properties cleaned up: 4
- VP material volume: 15,600 cubic yards (11,900cubic meters)
- Citizen advisory committee: None
- Public participation: Haul road safety

The mill site at Monument Valley before remediation.



The mill site at Monument Valley after remediation.

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	1,598
Env. Health & Safety/NEPA	1,045
RA Design	632
Site Acquisition	—
RA Field Management	With Mexican Hat
Site Preparation	—
Tailings Handling	7,500
Cover Material	—
Erosion Protection	—
Site Restoration	900
All Other Construction Costs	4,759
VP Design	73
VP Construction	934
Surveillance & Maintenance	52
Site Specific Total	$17,493

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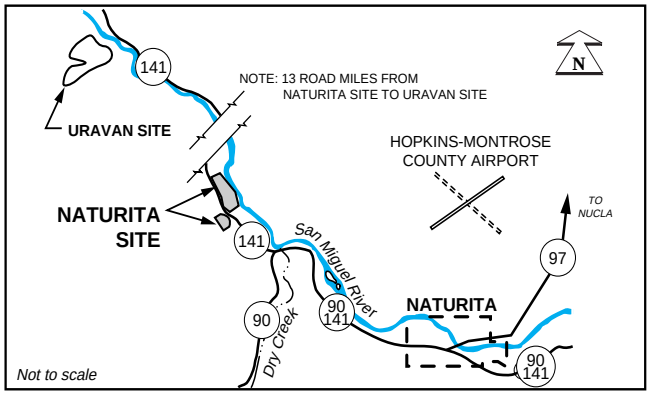
Naturita, Colorado

Site Description

The former Naturita mill site is located two miles (3.2 kilometers) northwest of the town of Naturita in Montrose County, CO. The tailings were removed by a previous owner; however, the 53-acre (21.5 hectares) site contained contaminated soil and numerous mill support buildings. An additional 85 acres (34.4 hectares) of land adjacent to the site are contaminated with RRM deposited by wind or water erosion from the site.



Site History

The mill was built in 1930 by Rare Metals Company but did not become operational until 1939 when Vanadium Corporation of America (VCA) acquired the mill and converted it for vanadium recovery. The mill was shut down at the end of World War II, but reopened in 1947 under contract to the Atomic Energy Commission (AEC). The Naturita mill produced uranium concentrates which were shipped to the AEC until the mill was shut down in 1958. From 1961 until 1963, an uranium upgrader was operated by VCA at the site. The mill was dismantled in 1963. In 1967, VCA merged with Foote Mineral Company and ownership of the site passed to Foote.

A portion of the former tailings site was purchased in 1976 by Rancher's Exploration of Albuquerque, N.M. Rancher's was then acquired by Hecla Mining Company. Between 1977 and 1979, Hecla removed the tailings and reprocessed them at another site. The remaining portion of the site is owned by Cyprus/Foote Mineral Company, which leased the land to General Electric Company for an uranium ore buying depot.

Remedial Action

Remedial action of the former processing site was conducted in two phases: Phase I, site demolition, asbestos and hazardous waste removal, treatment, storage and disposal off site began in May 1994 and was completed in November of that year. Phase II involved the removal of RRM, including debris from the demolished mill, and transporting it to a disposal site in Uravan, CO, 13 miles (21 kilometers) northwest of the processing site. There, the RRM was placed in a disposal cell to isolate it from the environment. Phase II began in June 1996 and was completed in September 1998.

Site Information

The disposal site is located on land formerly owned by Umetco Mineral Corporation. The DOE acquired the disposal site land via valuable consideration on June 16, 1997. The sale consisted of 26.65 acres (10.8 hectares) in accordance with the terms of the UMTRCA. The cell was constructed adjacent to Umetco's Title II cell.

SCHEDULE MILESTONES

- (EA) FONSI: January 1995
- Date contractor mobilized: July 1996
- Date contractor demobilized: October 1998
- Final RAP: March 1999
- Date mill site is to be certified: June 1999
- Date disposal cell is to be licensed: June 1999

CELL STATISTICS

- Method of containment: Relocate to Upper Burbank Repository
- Volume of contaminated material handled: 793,193 cubic yards (606,881 cubic meters)
- Volume of contaminated material in cell: 793,193 cubic yards (606,881 cubic meters)
- Average RRM radioactivity: 46 pCi/g, Ra-226
- Total radioactivity in cell: 79 Curies, Ra-226
- Cell dimensions: The Upper Burbank disposal cell is located in the north end of a rock quarry developed by Umetco Minerals Corporation. Being a quarry pit, the site is essentially a large hole excavated into solid bedrock along the southern rim of Club Mesa with rock slopes on three sides and an open end on the other.

The cell occupies 10 acres (4.1 hectares) and is roughly rectangular in shape. It rises some 80 feet (24 meters) above the bottom of the pit, and is approximately 830 feet (253 meters) long and 820 feet 250 meters) wide.

- Cell design: The cell features a 10-foot (3 meters)- thick multilayered cover. Contaminated materials were covered with a 3-foot (0.9 meters)-thick clay radon barrier, a 5.5-foot (1.7 meters)-thick freeze-thaw barrier, a 6-inch 0.15 meters) bedding layer and a 1-foot (0.3 meters)-thick erosion protection layer of rock (Type A, B, or C riprap.).

CONSTRUCTION STATISTICS

- Truck miles driven: 1,402,528 (2,262,142 kilometers)
- Estimated risk reduction: 0.91 deaths prevented
- Peak employment level: 40
- Safety record:
  - Total Recordable Rate - 2.4
  - Total Lost Workday Rate - 0.5
- Remediation subcontractor: Granite Construction
- Contaminated Material
  - Equipment and method: Highway trucks and bottom dump trailers

The mill site at Naturita prior to clean up by the DOE.

The mill site at Naturita after remediation.

- Haul distance: 13 miles (21 kilometers)

• Cover Material:
  - Radon Barrier
    -- Source: Club Mesa Borrow
    -- Type material: Clay
    -- Haul distance: 3,000 feet (910 meters)
    -- Equipment and method: Truck
    -- Quantity: 44,880 cubic yards (34,338 cubic meters)
    -- Bentonite %: None
  - Frost Barrier
    -- Source: Club Mesa Borrow
    -- Type material: Clay
    -- Haul distance: 3,000 feet (910 meters)
    -- Equipment and method: Truck
    -- Quantity: 89,000 cubic yards (68,100 cubic meters)

• Erosion Protection:
  - Bedding
    -- Source: West End Pit Valley Quarry
    -- Type material: Igneous (Alluvial)
    -- Haul distance: 23 miles (37 kilometers)
    -- Quantity: 14,740 cubic yards (11,280 cubic meters)
    -- Gradation: 3 inches (7.6 centimeters) minus

  - Type A
    -- Source: West End Pit Valley Quarry
    -- Type material: Igneous (Alluvial)
    -- Haul distance: 23 miles (37 kilometers)
    -- Quantity: 7,100 cubic yards (5430 cubic meters)
    -- Gradation: 3 inches (7.6 centimeters) minus
  - Type B
    -- Source: West End Pit Valley Quarry
    -- Type material: Igneous (Alluvial)
    -- Haul distance: 23 miles (37 kilometers)
    -- Quantity: 27,500 cubic yards (21,000 cubic meters)
    -- Gradation: 10 inches (25.4 centimeters) minus
  - Type B1
    -- Source: Cheney Stockpile
    -- Type material: Basalt
    -- Haul distance: 100 miles (161 kilometers)
    -- Quantity: 7,000 cubic yards (5,300 cubic meters)
    -- Gradation: 12 inches (30.5 centimeters) minus
  - Type: Large Size Rock
    -- Source: Club Mesa Borrow
    -- Type material: Sandstone
    -- Haul distance: 3,000 feet (910 meters)
    -- Quantity: 12,000 cubic yards (9200 cubic meters)
    -- Gradation: Variable

OTHER INFORMATION

• Vicinity properties cleaned up: 52
• VP material handled: 38,220 cubic yards (29,220 cubic meters)
• Citizen advisory committee: Naturita UMTRA Project Citizens Advisory Council
• Public participation issues: Disposal cell site selection, EA availability, potential impact of remedial action on emergency services and housing, fairness of contracting procedures to local contractors, and the amount of backfill required to bring the mill site back to its original condition.

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	3,315
Env. Health & Safety/NEPA	1,339
RA Design	5,054
Site Acquisition	2,178
RA Field Management	14,062
Site Preparation	3,950
Tailings Handling	13,172
Cover Material	490
Erosion Protection	2,035
Site Restoration	5,878
All Other Construction Costs	3,971
VP Design	1,213
VP Construction	2,991
Surveillance & Maintenance	182
Site Specific Total	$59,830

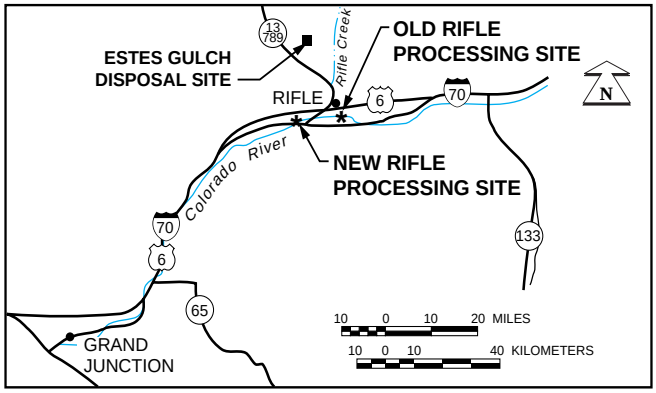
The mill site at the Upper Burbank Respository after remediation.

Rifle, Colorado

Site Description

The two inactive uranium processing sites were located in the Colorado River valley near the city of Rifle. The sites are about two miles (3.2 kilometers) apart and are referred to as the Old Rifle and New Rifle sites.

Old Rifle is located just east of the Rifle city limits in Garfield County, CO. It is bounded by U.S. Highway 24 on the north and the Denver and Rio Grande Western Railroad tracks on the south. The Colorado River



is immediately south of the railroad tracks. It is a 22 acre (8.9 hectares) site where the RRM covered approximately 13 acres (5.3 hectares) of land.

The New Rifle site is west of the city of Rifle. It is bordered on the north by the Denver and Rio Grande Western Railroad tracks, on the south by Interstate 70 and on the east by the Colorado River. The RRM covered about 33 acres (13.4 hectares) of land and the pile had very steep side slopes rising to a height of about 55 feet (17 meters).

Site History

The Old Rifle site operated from 1924 to 1932 for the recovery of vanadium from roscoelite ore. The process was altered to include recovery of uranium from 1947 to 1958. The New Rifle mill operated from 1958 to 1973 as part of a complex of upgraders that included those located at Slick Rock, CO and Green River, UT.

Remedial Action

Phase I remediation was performed at the New and Old Rifle sites between September 1988 and September 1989. These actions included establishing temporary construction facilities, bagging and storing asbestos on-site, removing other chemicals and materials, demolishing unstable and unsafe mill structures, and improving site security. Vanadium- contaminated materials were transferred to a vanadium refining facility for reprocessing. All non-radioactive hazardous materials were transferred to a licensed disposal facility.

Phase II remedial action started in April 1992. It involved removing the RRM and transporting it to the Estes Gulch disposal site approximately seven miles (11 kilometers) north of the city of Rifle.

The former processing sites were backfilled with uncontaminated soil to an elevation compatible with the surrounding terrain, recontoured to promote surface drainage and reseeded. Work at the two sites was completed in October 1996. The State of Colorado is the current owner of both sites, which will eventually be released for restricted use.

The disposal cell, located at Estes Gulch about seven miles (11 kilometers) north of the city of Rifle, occupies 71 acres (28.7 hectares).

Site Information

The disposal site was formerly administered by the BLM. The site was transferred to the federal government in 1998.

SCHEDULE MILESTONES

- (EIS) ROD: January 1991
- Final RAP: February 1992
- Date contractor mobilized: May 1992
- Date contractor demobilized: November 1996
- Date mill sites certified: January 1998
- Date disposal cell licensed: January 1998

CELL STATISTICS

- Method of containment: Relocate to Estes Gulch
- Volume of contaminated material handled: 3,759,900 cubic yards (2,876,700 cubic meters)
- Volume of contaminated material in cell: 3,759,900 cubic yards (2,876,700 cubic meters)

- Average tailings radioactivity: 650 pCi/g (Old Rifle), 760 pCi/g (New Rifle), Ra-226
- Total radioactivity in cell: 2,738 Curies, Ra-226
- Cell dimensions: The cell covers 71 acres (28.7 hectares). It is roughly triangular in shape and is constructed partially below grade. It rises 76 feet (23 meters) above the surrounding terrain, and is approximately 3,200 feet (975 meters) long and 2,900 feet (880 meters) wide. It is approximately 87 feet (26 meters) deep from its highest to its lowest point.
- Cell design: The cell features an 11.5-foot (3.5 meters)-thickmultilayered cover. Contaminated materials were covered with a 1.5-foot (0.46 meters)-thick radon/infiltration barrier consisting of six inches (0.15 meters) of compacted clay and a 1-foot (0.3 meters) layer of bentonite-amended clay.

This was covered by a six-inch (0.15 meters) frost barrier, a six-inch (0.15 meters) coarse-grained filter layer, an average 7.5-foot (2.3 meters)-thick freeze-thaw layer of compacted soil, a six-inch (0.15 meters) bedding layer, and a 1-foot (0.3 meters) erosion protection layer of Type A riprap.

CONSTRUCTION STATISTICS

- Truck miles driven: 5,107,584 (8,238,040 kilometers)
- Estimated risk reduction: 40 deaths prevented
- Peak employment level: 103
- Safety record:

The New Rifle mill site before DOE cleanup.

The mill site at New Rifle after cleanup.

- Total Recordable Rate - 7.0
- Total Lost Workday Rate - 5.5

• Remediation subcontractor: Green International,Inc.
• Contaminated Material:
- Equipment and method: Highway trucks and bottom dump trailers
- Haul distance: 7 miles (11 kilometers)

• Cover Material:
- Radon barrier
-- Source: Borrow
-- Type material: Clay with Bentonite
-- Haul distance: 3,000 feet (915 meters)
-- Equpment and method: Wheel tractor scraper
-- Quantity: 144,000 cubic yards (110,200 cubic meters)
-- Bentonite%: 4%
- Frost barrier
-- Source: Borrow
-- Type material: Silty sand
-- Haul distance: 3,000 feet (915 meters)
-- Equpment and method: Wheel tractor scraper
-- Quantity: 992,000 cubic yards (759,000 cubic meters

• Erosion Protection:
- Bedding
-- Source: Con-Sy Quarry
-- Type material: River run
-- Haul distance: 6 miles (10 kilometers)
-- Quantity: 125,000 cubic yards (95,000 cubic meters)
-- Gradation: Type D2 - 3/4 inch (1.9 centimeters) (drainage aggregate), Type D1 - 1-1/2 inches (3.8 centimeters)

- Type A
-- Source: Con-Sy Quarry and Frei Pit at Silt, CO
-- Type material: River run
-- Haul distance: 13 miles (21 kilometers)
-- Quantity: 113,900 cubic yards (87,100 cubic meters)
-- Gradation: 6 inches (15.2 centimeters) minus
- Type B
-- Source: Con-Sy Quarry and Frei Pit at Silt, CO
-- Type material: River run
-- Haul distance: 13 miles (21 kilometers)
-- Quantity: 40,000 cubic yards (30,600 cubic meters)
-- Gradation: 10 inches (25.r centimeters) x 2-1/2 inches (6.4 centimeters)
- Type C
-- Source: Mackley Pit at Rulison, CO and Frei Pit at Silt, CO
-- Type material: River run
-- Haul distance: 15 and 13 miles (24 and 21 kilometers)
-- Quantity: 3,700 cubic yards (2,800 cubic meters)
-- Gradation: 24 inches (61 centimeters) x 8 inches (20.3 centimeters)
- Type D
-- Source: Mackley Pit at Rulison, CO
-- Type material: River run
-- Haul distance: 15 miles (24 kilometers)
-- Quantity: 1,300 cubic yards (995 cubic meters)
-- Gradation: 42 inches (106.7 centimeters) x 8 inches (20.3 centimeters)

OTHER INFORMATION

• Vicinity properties cleaned up: 113
• VP material volume: 192,636 cubic yards (147,388 cubic meters)
• Citizen advisory committee: Rifle UMTRA Citizens Task Force
• Public participation issues: Impact of tailings haul on public roads. Haul road safety. Replacement of wetlands.

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	5,539
Env. Health & Safety/NEPA	2,175
RA Design	6,659
Site Acquisition	202
RA Field Management	19,863
Site Preparation	13,429
Tailings Handling	24,486
Cover Material	3,758
Erosion Protection	4,115
Site Restoration	6,517
All Other Construction Costs	6,841
VP Design	1,007
VP Construction	5,373
Surveillance & Maintenance	190
Site Specific Total	$100,154

The Old Rifle mill site before remediation.

The mill site at Old Rifle after remediation.

The Rifle disposal cell at Estes Gulch following its completion.

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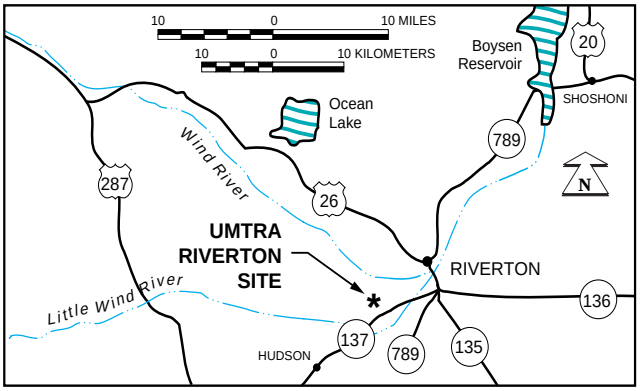
Riverton, Wyoming

Site Description

The former Riverton mill and tailings site is located 2.5 miles (4 kilometers) southwest of the town of Riverton on the north side of state highway 789 in Fremont County, WY, and covers 170 acres (68.8 hectares). Before remedial action, the RRM occupied about 72 acres (29.1 hectares) in piles with an average depth of four feet (1.2 meters).



Site History

The site is located on a privately-owned parcel of land within the boundaries of the Wind River Indian Reservation, which is occupied by the Shoshone and Northern Arapaho Tribes. Susquehanna-Western, Inc., formerly known as Fremont Minerals, Inc., was the operational owner of the site beginning in 1958. Solution Engineering Corporation of Alice, Texas, later acquired the mill and owned it until 1978, when Lome Drilling and Well Service, a Wyoming corporation, purchased most of the site. Western Nuclear, Inc., owned part of the mill area and operated a sulfuric acid plant at the site. In August 1985, Chemical Marketing Services purchased the plant, then sold it in March 1991 to Koch Sulfur Products. The State of Wyoming acquired the tailings pile and mill site in 1987.

Remedial Action

Remedial action at the Riverton site began in March 1988 and was completed in September 1990. The cleanup involved relocating the RRM to an active mill site operated by Umetco in the Gas Hills Uranium Mining District 45 miles (73 kilometers) east of Riverton. There, the RRM was consolidated with existing Title II tailings at the Umetco mill site and stabilized.

After decontamination of the Susquehanna-Western mill tailings site, the cleaned up areas at the site were backfilled with uncontaminated soil to a level compatible with the surrounding terrain, recontoured to promote surface drainage, and revegetated. Since the tailings were disposed of at an active Title II facility, there was no need for DOE to acquire the disposal site. However, DOE must still fulfill the requirements of the UMTRA groundwater restoration program and maintain control of the former mill site property until all phases of the Riverton UMTRA Project are complete.

In January 1995, the NRC concurred with DOE's certification that the site surface remedial action was complete and met applicable EPA standards.

Site Information

SCHEDULE MILESTONES

- (EA) FONSI: July 1987
- Final RAP: October 1987
- Date contractor mobilized: May 1988
- Date contractor demobilized: September 1990
- Date mill site certified: January 1995
- Date disposal cell licensed: Not required; no disposal cell to license

CELL STATISTICS

- Method of containment: Relocate to Gas Hills Title II facility
- Volume of contaminated material handled: 1,792,631 cubic yards (1,371,562 cubic meters)
- Average tailings radioactivity: 292 pCi/g, Ra-226
- Cell dimensions: N/A
- Cell design: N/A

CONSTRUCTION STATISTICS

- Truck miles driven: 5,957,159 (9,608,320 kilometers)
- Estimated risk reduction: 5.6 deaths prevented
- Peak employment level: 85
- Safety record:
  - Total Recordable Rate - 2.2
  - Total Lost Workdate Rate - 1.0
- Remediation subcontractor: Umetco Materials, Corp.

OTHER INFORMATION

- Vicinity properties cleaned up: 42
- VP material handled: 179,619 cubic yards (137,428 cubic meters)
- Citizen advisory committee: None
- Public participation issues: Groundwater contamination concerns.

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	1,999
Env. Health & Safety/NEPA	1,188
RA Design	586
Site Acquisition	351
RA Field Management	3,937
Site Preparation	1,430
Tailings Handling	19,152
Cover Material	—
Erosion Protection	—
Site Restoration	2,182
All Other Construction Costs	4,669
VP Design	505
VP Construction	2,922
Surveillance & Maintenance	139
Site Specific Total	$39,060

The mill site at Riverton before DOE cleanup.

The mill site at Riverton after DOE cleanup.

The disposal site at Gas Hills, WY.

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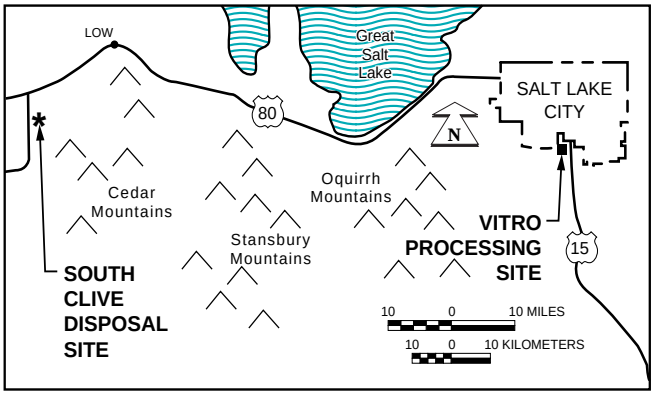
Salt Lake City, Utah

Site Description

The 128-acre (51.8 hectares) former Salt Lake City mill and processing site, known as the Vitro site, is located about four miles (6.5 kilometers) south-southwest of the center of Salt Lake City. An ore-processing mill, ore storage and transportation facilities were located on eight acres (3.2 hectares) at the eastern portion of the site. The RRM occupied the remaining 120 acres (48.6 hectares) with piles up to 16 feet (4.9 meters) in height.



Site History

Originally, the plant was built in the Salt Lake valley during World War II for the production of aluminum from aluminite. In 1951, Vitro Corporation of America acquired the plant to process uranium ore. This occurred from 1951 to January 1964. The plant was then converted to produce vanadium. Production ceased in 1968 and the plant was dismantled by 1970. The site has changed ownership several times and is now owned by the Central Valley Water Treatment Facility Board.

Remedial Action

The remedial action, carried out by the State of Utah, involved excavating the RRM, then transporting it by rail and truck to Clive, UT, located 85 miles (137 kilometers) west of Salt Lake City. Remedial action was initiated in February 1985 and completed in June 1989.

Site Information

The South Clive disposal site was acquired by the Utah Division of Environmental Health from the Utah State Land Board. The state filed the conveyance on September 19, 1997 transferring ownership to the federal government.

SCHEDULE MILESTONES

- (EIS) ROD: October 1984
- Final RAP: December 1984
- Date contractor mobilized: January 1985
- Date contractor demobilized: May 1989
- Date mill site certified: September 1997
- Date disposal cell licensed: September 1997

CELL STATISTICS

- Method of containment: Relocate to South Clive disposal site
- Volume of contaminated material handled: 2,798,000 cubic yards (2,140,700 cubic meters)
- Volume of contaminated material in cell: 2,798,000 cubic yards (2,140,700 cubic meters)
- Average tailings radioactivity: 481 pCi/g, Ra-226
- Total radioactivity in cell: 1,550 Curies, Ra-226
- Cell dimensions: The disposal cell occupies 54 acres (22 hectares), is rectangular in shape and is constructed partially below grade. It rises 35 feet (10 meters) above the surrounding terrain, and is approximately 2,110 feet (640 meters) long and 1,115 feet (340 meters) wide. It is approximately 40 feet (12 meters) deep from its highest to its lowest point.
- Cell design: The cell features a 9-foot (2.7 meters)-thick multilayered cover. Contaminated materials were covered with a 7-foot (2.1 meters)-thick layer of silty clay, which serves as a radon and infiltration barrier. A 6-inch layer (0.15 meters) of sand and a 1.5 foot (0.46 meters) layer of rock were then placed on the cell's top and sides. This serves as a barrier to erosion, plant infiltration and burrowing animals. Top slopes have a two percent grade; sideslopes are graded to 20 percent.

CONSTRUCTION STATISTICS*

- Estimated risk reduction: 313 deaths prevented
- Peak employment level: 70
- Remediation subcontractor: Tolboe Construction Co.
- Contaminated material:
  - Equipment and method: Rail
  - Haul distance: 70 miles (113 kilometers)

* Construction information: Not reported by State of Utah

OTHER INFORMATION

- Vicinity properties cleaned up: 119
- VP material handled: 224, 284 cubic yards (171,602 cubic meters)
- Citizen advisory committee: None
- Public participation issues: Off site disposal. State of Utah managed remedial action.

The mill site at Salt Lake City before remediation.

The mill site at Salt Lake City after remediation.

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	2,812
Env. Health & Safety/NEPA	1,867
RA Design	661
Site Acquisition	509
RA Field Management	1,667
Site Preparation*	Not Available
Tailings Handling*	Not Available
Cover Material*	Not Available
Erosion Protection*	Not Available
Site Restoration*	Not Available
All Other Construction Costs**	57,045
VP Design	3,982
VP Construction	15,129
Surveillance & Maintenance	275
Site Specific Total	$83,947

* Information not reported by State of Utah

** State of Utah reported one number for all construction cost

The Salt Lake City disposal site at Clive, UT.

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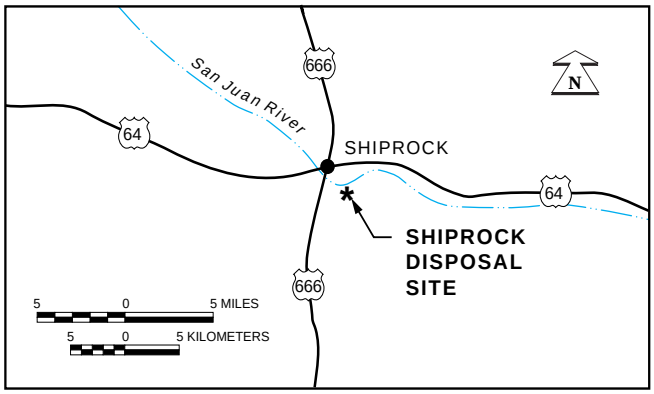
Shiprock, New Mexico

Site Description

The former Shiprock mill site was located on a 230-acre (93.1 hectares) tract of Navajo Nation land adjacent to the south bank of the San Juan River in the town of Shiprock. The tailings were dispersed in two piles covering approximately 72 acres (29.1 hectares). A former raffinate pond (a basin to contain spent liquids from the milling process) and a few mill buildings were located to the west of the piles.



Site History

Kerr-McGee Oil Industries, Inc., operated a uranium processing mill at Shiprock from 1954 to 1963. The Vanadium Corporation of America and its successor, Foote Mineral Company, operated the mill from 1963 to 1968. Before and during the milling operations, the site was leased from the Navajo Nation. When the Foote Mineral Company's lease expired in 1973, full control of the site reverted to the Navajo Nation.

Remedial Action

Cleanup of the Shiprock site began in October 1984 and was completed in October 1986, with the RRM stabilized in place. The RRM was consolidated into one pile and covered. The cover consists of a compacted clay layer which serves as a radon barrier, and a rock layer which protects the disposal cell from erosion. In May 1991, the NRC concurred with the DOE that the surface cleanup of the site was complete and met applicable EPA standards. The NRC licensed the site in September 1996.

Site Information

The Navajo Nation retains ownership of the disposal site. However, the DOE entered into a custodial care agreement with the Navajos to restrict entry and public use, and to provide federal access for long-term care activities.

SCHEDULE MILESTONES

- (EA) FONSI: July 1984
- Date contractor mobilized: October 1984
- Final RAP: June 1985
- Date contractor demobilized: November 1986
- Date mill site certified: May 1991
- Date disposal cell licensed: September 1996

CELL STATISTICS

- Method of containment: Stabilize in place
- Volume of contaminated material handled: 1,079,000 cubic yards (825,000 cubic meters)
- Volume of contaminated material in cell: 1,864,800 cubic yards (1,426,000 cubic meters)
- Average tailings radioactivity: 422 pCi/g, Ra-266
- Total radioactivity in cell: 748 Curies, Ra-226
- Cell dimensions: The above-ground disposal cell covers approximately 77 acres (31 hectares) and is an asymmetrical pentagon. The cell is approximately 2,150 feet (655 meters) long by 1,700 feet (520 meters) wide and rises some 48 feet (15 meters) above the original ground surface.
- Cell design: The cell has a three-layer, 8.5-foot (2.6 meters)-thick cover. Contaminated materials are covered with an infiltration/radon barrier of compacted sandy silt which is 6.4-feet (2 meters)-thick on the top and 7 feet (2.1 meters)-thick on the sides. This is covered by a 6-inch (0.15 meter) layer of bedding material and one foot (0.3 meter) erosion protection layer of rock (Type A riprap on the top and Type B on the sides). The top slope varies from two to four percent; sideslopes are graded to 20 percent.

CONSTRUCTION STATISTICS

- Estimated risk reduction: 20 deaths prevented
- Safety record:
  - Total Recordable Rate - 2.0
  - Total Lost Workday Rate - 0.0
- Remediation subcontractor: Navajo Engineering Construction Authority (NECA)
- Contaminated Material:
  - Equipment and method: Scrapers

- Haul distance: 3,000 feet (915 meters)

• Cover Material:
- Radon barrier
-- Source: Borrow area on-site
-- Type material: Sandy silt
-- Haul distance: 3,000 feet (915 meters)
-- Equpment and method: Scraper
-- Quantity: 765,378 cubic yards (585,599 cubic meters) (7 feet [2.1 meters] thick)
-- Bentonite %: None
- Frost barrier: None

• Erosion Protection:
- Bedding
-- Source:
-- Type material:
-- Haul distance:
-- Quantity: 98,285 cubic yards (75,199 cubic meters)
-- Gradation: 3 inches (7.6 centimeters) minus
- Type A
-- Source: NECA borrow area
-- Type material: locally screened gravels
-- Haul distance: 2,000 feet (610 meters)
-- Quantity: 211,075 ton (191,000 metric tons)
-- Gradation: 4 inches (10.2 centimeters) minus
- Type B
-- Source: NECA borrow area
-- Type material: locally screened gravels
-- Haul distance: 2,000 feet (610 meters)
-- Quantity: 11,112 ton (10,080 metric tons)
-- Gradation: 10 inches (25.4 centimeters) minus

OTHER INFORMATION

• Vicinity properties cleaned up : 15
• VP material handled: 10,427 cubic yards (79,778 cubic meters)
• Citizen advisory committee: None
• Public participation issues: Custodial care agreement

The mill site at Shiprock before DOE cleanup.

The mill site with disposal cell at Shiprock after DOE cleanup.

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	1,543
Env. Health & Safety/NEPA	1,118
RA Design	995
Site Acquisition	—
RA Field Management	1,872
Site Preparation	725
Tailings Handling	2,406
Cover Material	1,301
Erosion Protection	2,705
Site Restoration	1,724
All Other Construction Costs	1,764
VP Design	365
VP Construction	508
Surveillance & Maintenance	734
Site Specific Total	$17,760

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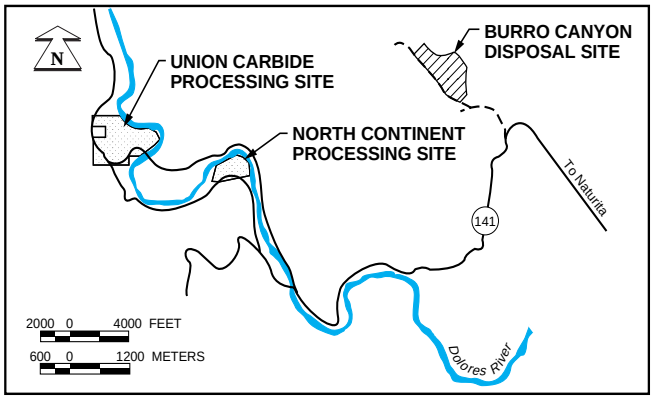
Slick Rock, Colorado

Site Description

The two sites at Slick Rock, located about one mile (1.6 kilometers) apart, are the Union Carbide Corporation (UC) site and the North Continent (NC) site. They are located 1.8 miles (2.9 kilometers) northwest of the old post office at Slick Rock, nine miles (14.5 kilometers) east of the Colorado-Utah border, and 25 miles (40 kilometers) north of Dove Creek, CO. The sites are in the Dolores River Valley. The UC site consists of 99 acres (40.1 hectares), with 17 acres (6.9 hectares) covered by tailings. The old mill buildings had already been removed before the start of remedial action. The NC site covers 44 acres (17.8 hectares).



In order to isolate the RRM from the environment, DOE built an engineered disposal cell at Burro Canyon about six miles (10 kilometers) northeast of the former processing sites.

Site History

Union Carbide has owned the UC site since 1956 and operated a uranium upgrader there from 1957 to 1961. The upgraded ore was then trucked to Union Carbide's Rifle, CO mill for further processing. Later, Rocky Mountain Natural Gas Co. constructed a plant on five acres of land next to the site.

Shattuck Chemical Co. was the original owner of the NC site, beginning in 1931. North Continent Mines, Inc., acquired the interests of Shattuck in 1934. Union Mines Development Corp., a U.S. Government-established corporation, acquired the site in 1945 to supply uranium and vanadium for the Manhattan Project in World War II. The federal government took title to the site in 1949, and in 1957, Union Carbide acquired the property. Umetco Mineral Corporation, a subsidiary of Union Carbide, now owns both sites.

Remedial Action

Construction activities at the Slick Rock UMTRA sites began in March 1995 and was completed in December 1996. RRM from both sites was trucked to the Burro Canyon disposal cell six miles (10 kilometers) away. Following removal of the RRM, both sites were graded and restored.

Site Information

The disposal cell is located on public land formerly administered by the BLM. It was transferred to DOE on May 4, 1995.

SCHEDULE MILESTONES

- (EA) FONSI: January 1995
- Date contractor mobilized: January 1995
- Final RAP: April 1995
- Date contractor demobilized: December 1996
- Date mill site certified: August 1998
- Date disposal cell licensed: August 1998

CELL STATISTICS

- Method of containment: Relocate to Burro Canyon
- Volume of contaminated material handled: 778,760 cubic yards (595,840 cubic meters)
- Volume of contaminated material in cell: 778,760 cubic yards (595,840 cubic meters)
- Average tailings radioactivity: 113 pCi/g, Ra-226
- Total radioactivity in cell: 149 Curies, Ra-226
- Cell dimensions: The Burro Canyon disposal cell covers 12 acres (4.9 hectares), is roughly rectangular in shape, and is approximately 900 feet (275 meters) long by 650 feet (200 meters) wide. It rises some 65 feet (20 meters) above the surrounding terrain and is approximately 95 feet (30 meters) deep from its highest to its lowest point. It is constructed partially below grade.
- Cell design: The cell is capped with a 5-foot (1.5 meters)-thick multiple component cover. A 1.5-foot (0.46 meters) radon/infiltration barrier of imported sandy clay was placed over the contaminated materials. A 2-foot (0.61 meter) layer of compacted soil lays on top of the radon barrier to prevent adverse

freeze-thaw effects. A 6-inch (0.15 meter) coarse-grained bedding layer was placed next to provide a capillary break and to promote drainage.

The topslopes and sideslopes were covered with rock to protect them from wind and water erosion. The top is 8 inches (0.2 meters) of Type A riprap; the sides are 12 inches (0.3 meters) of Type B riprap. The maximum topslope grade is four percent with 25 percent on the sideslopes.

CONSTRUCTION STATISTICS

- Truck miles driven: 705,206 (1,137,429 kilometers)
- Estimated risk reduction: 0.003 deaths prevented
- Peak employment level: 160
- Safety record:
  - Total Recordable Rate - 2.7
  - Total Lost Workday Rate - 1.3
- Remediation subcontractor: Nielsons, Inc.
- Contaminated Material:
  - Equipment and method: Highway truck with end dump and belly dump trailers
  - Haul distance: 5 miles (8 kilometers)

The UC mill site at Slick Rock before remediation.

The UC mill site at Slick Rock following DOE cleanup.

- Cover Material:
  - Radon barrier
    - Source: Suckla Borrow area
    - Type material: Clayey sand
    - Haul distance: 6 miles (10 kilometers)
    - Equipment and method: Highway truck with end dump and belly dump trailers
    - Quantity: 28,594 cubic yards (21,878 cubic meters)
    - Bentonite %: None
  - Frost barrier
    - Source: On-site borrow from cell excavation
    - Type material: Clayey sand
    - Haul distance: 200 to 1,000 feet (60 to 300 meters)
    - Equipment and method: Trucks, belly dump trailers, and scrapers
    - Quantity: 24,188 cubic yards (18,507 cubic meters)
- Erosion Protection:

The NC mill site at Slick Rock before cleanup.

The NC mill site at Slick Rock after remediation.

- Bedding
  - Source: Dolores River Borrow area
  - Type material: River run gravel
  - Haul distance: 5 miles (8 kilometers)
  - Quantity: 10,800 cubic yards (8,260 cubic meters)
  - Gradation: 3 inches (7.6 centimeters) minus

- Type A
  - Source: Dolores River Borrow area
  - Type material: River run gravel
  - Haul distance: 5 miles (8 kilometers)
  - Quantity: 3,317 cubic yards (2,538 cubic meters)
  - Gradation: 3 inches (7.6 centimeters) minus
- Type B
  - Source: Dolores River Borrow area
  - Type material: River run gravel
  - Haul distance: 5 miles (8 kilometers)
  - Quantity: 11,838 cubic yards (9,507 cubic meters)
  - Gradation: 7 inches (17.8 centimeters) minus
- Type C
  - Source: Dolores River Borrow area
  - Type material: River run gravel
  - Haul distance: 5 miles (8 kilometers)
  - Quantity: 4,515 cubic yards (3,454 cubic meters)
  - Gradation: 10 inches (25.4 centimeters) minus
- Type C1
  - Source: Dolores River Borrow area
  - Type material: River run gravel
  - Haul distance: 5 miles (8 kilometers)
  - Quantity: 2,160 cubic yards (1,640 cubic meters
  - Gradation: 15 inches (38.1 centimeters) minus

OTHER INFORMATION

- Vicinity properties cleaned up: 17
- VP material handled: 3,325 cubic yards (2,544 cubic meters)
- Citizen advisory committee: Slick Rock UMTRA Citizens Advisory Committee
- Public participation issues: Impact on wildlife, local hiring, use of state road for hauling vs. construction of Burro Canyon road, resolution of disposal site mining claims and grazing rights issues, and resolution RAP concurrence, and land transfer issues.

The disposal cell at Burro Canyon following its completion.

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	2,892
Env. Health & Safety/NEPA	1,099
RA Design	3,539
Site Acquisition	143
RA Field Management	8,103
Site Preparation	5,876
Tailings Handling	8,073
Cover Material	553
Erosion Protection	797
Site Restoration	879
All Other Construction Costs	3,497
VP Design	171
VP Construction	317
Surveillance & Maintenance	125
Site Specific Total	$36,064

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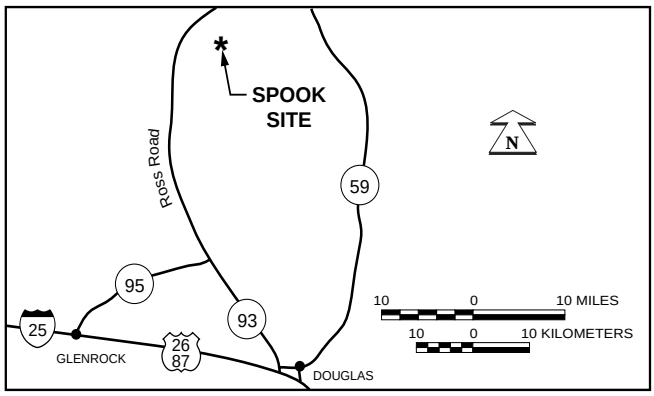
Spook, Wyoming

Site Description

The former Spook mill and tailings site is located approximately 48 miles (77 kilometers) northeast of Casper, WY in Converse County, and 32 miles (52 kilometers) northeast of Glenrock, WY. The site covers about 55 acres (22 hectares). The RRM occupied about five acres (2 hectares), mostly in an open pit mine which was 100 feet (30 meters) deep at its deepest point.



Site History

The Wyoming Mining and Milling Company operated a uranium upgrader on the site to concentrate uranium ore before shipment to the Western Nuclear Mill at Jeffrey City, WY. The upgrader became operational in 1962 and ran until 1965. The former processing site is currently owned by the State of Wyoming and Richard T. Hornbuckle, while DOE owns the disposal cell site.

Remedial Action

The remedial action project for the Spook uranium mill tailings site was a joint effort between the UMTRA Project and the Wyoming Abandoned Mine Lands Program. The UMTRA Project portion of the remedial action involved stabilizing the RRM within an inactive open pit mine on the site. The AML Program was responsible for backfilling the open pit with uncontaminated soil and restoring disturbed areas to premining conditions.

Remedial action began in April 1989 was completed in September 1989. The NRC licensed the site in September 1993, concurring with DOE that following remedial action the site met applicable EPA standards. The Spook site was the first UMTRA disposal cell to be brought in under the NRC's general license. In April 1994, DOE transferred responsibility for the site to its Grand Junction Office in Grand Junction, CO for long-term surveillance.

Site Information

The State of Wyoming acquired a 13.52-acre (5.5 hectares) parcel of land from the Hornbuckle Ranch on October 6, 1989. Subsurface rights to 80 acres (32.4 hectares) were permanently transferred to DOE by BLM on October 19, 1990. And a 9-acre (3.6 hectares) portion of a unpatented mining claim was acquired from Rio Algom Mining Corp. by the U.S. Army Corps of Engineers.

SCHEDULE MILESTONES

- (EA) FONSI: April 1989
- Date contractor mobilized: April 1989
- Date contractor demobilized: September 1989
- Final RAP: March 1990
- Date mill site certified: March 1992
- Date disposal cell licensed: September 1993

CELL STATISTICS

- Method of containment: Stabilize on site
- Volume of contaminated material handled: 314,309 cubic yards (240,481 cubic meters)
- Volume of contaminated material in cell: 314,309 cubic yards (240,481 cubic meters)
- Average tailings radioactivity: 320 pCi/g, Ra-226
- Total radioactivity in cell: 125 Curies, Ra-226
- Cell dimensions: The Spook disposal cell is roughly oval in shape and is approximately 740 feet (225 meters) long by 550 feet (170 meters) wide. The cell is 54 feet (16 meters) deep from its highest to its lowest point.
- Cell design: The contaminated materials are buried in an open pit uranium mine above a 3 foot (0.9 meters) foundation layer in the south-central portion of the pit. Tailings are covered with a 1.5 foot (0.46 meters)-thick low-permeability layer. This was covered by a 10-foot (3 meters) high permeability layer. Topslopes have a 5.9 to 6.3 percent grade; sideslopes are graded to 50 percent. The entire cell was then buried with 35 to 55 feet (10 to 17 meters) of soil. The site's surface was contoured to approxi-

mate pre-mining topographic conditions and seeded with native grasses.

CONSTRUCTION STATISTICS

- Truck miles driven: 860,076 (1,387,219 kilometers)
- Estimated risk reduction: 0.002 deaths prevented
- Peak employment level: 47
- Safety record:
  - Total Recordable Rate - 0.0
  - Total Lost Workday Rate - 0.0
- Remediation subcontractor: Jim's Water Service
- Contaminated material
  - Equipment and method:
  - Haul distance: 2,000 feet (610 meters)

OTHER INFORMATION

- Vicinity properties cleaned up: 2
- VP material handled: 42,660 cubic yards (32,640 cubic meters)
- Citizen advisory committee: None
- Public participation issues: None

The mill site at Spook before DOE cleanup.

The mill site and disposal cell at Spook after remediation.

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	1,210
Env. Health & Safety/NEPA	831
RA Design	710
Site Acquisition	35
RA Field Management	814
Site Preparation	151
Tailings Handling	435
Cover Material	—
Erosion Protection	—
Site Restoration	314
All Other Construction Costs	381
VP Design	45
VP Construction	459
Surveillance & Maintenance	113
Site Specific Total	$5,498

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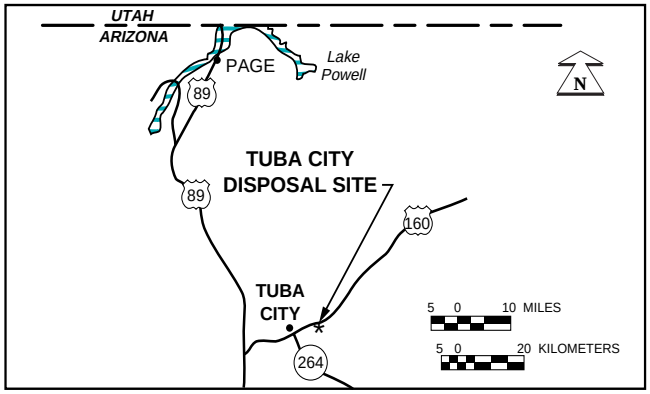
Tuba City, Arizona

Site Description

The former Tuba City mill and tailings site is located 5.5 miles (9 kilometers) east of Tuba City in Coconino County, AZ, and 92 miles (148 kilometers) north of Flagstaff. It consists of about 105 acres (42.5 hectares), of which 22 acres (8.9 hectares) were covered by the tailings pile, 44 acres (17.8 hectares) were former evaporation ponds and the remaining acres were a result of windblown RRM.



Site History

The Tuba City mill was built in 1955-56 by Rare Metals Corporation of America and included limited employee housing at the site. The Rare Metals Corporation merged with the El Paso Natural Gas Company in 1962 and operated the mill until 1966.

Remedial Action

The remedial action at the Tuba City site was conducted in two phases. Phase I, which consisted of demolition of buildings and site preparation activities, began in January 1985 and was completed in February 1986. In Phase II, the RRM on and near the former processing site was combined and compacted into the existing tailings pile. Phase II construction started in January 1988 and was completed in April 1990.

Site ownership will remain with the Navajo Nation, but DOE will be responsible for its long-term care and monitoring.

Site Information

Title to the disposal site was retained by the Navajo Nation. A Custodial Access Agreement was executed in September 1996 conveying to the federal government title to the RRM stabilized within the disposal cell.

SCHEDULE MILESTONES

- (EA) FONSI: February 1987
- Final RAP: August 1989
- Date contractor mobilized: February 1988
- Date contractor demobilized: May 1990
- Date mill site certified: April 1996
- Date disposal cell licensed: November 1996

CELL STATISTICS

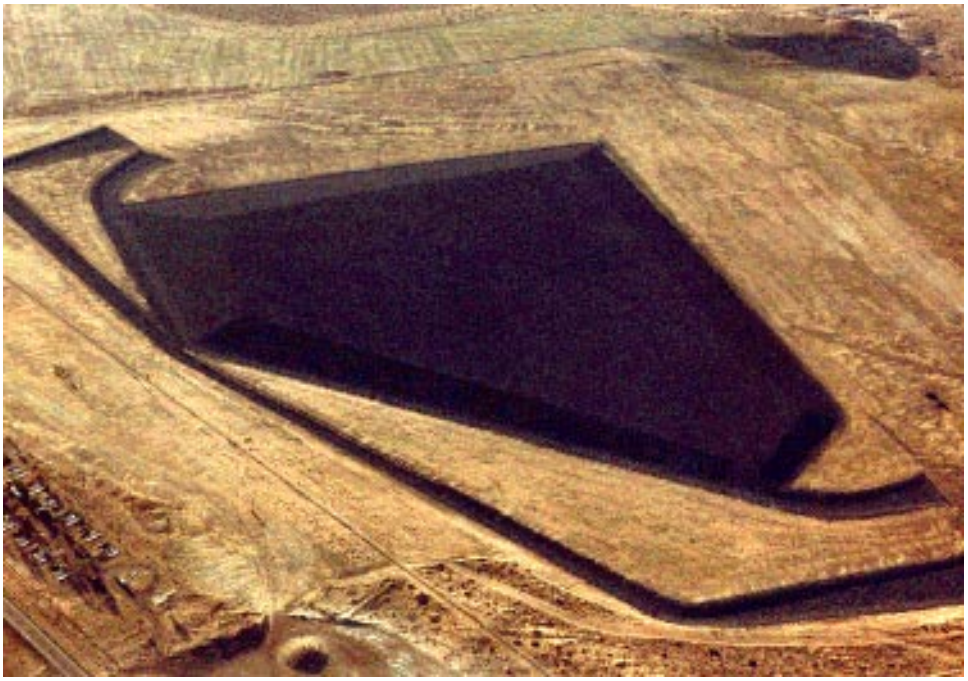
- Method of containment: Stabilize in place
- Volume of contaminated material handled: 980,000 cubic yards (749,800 cubic meters)
- Volume of contaminated material in cell: 1,630,500 cubic yards (1,247,500 cubic meters)
- Average tailings radioactivity: 441 pCi/g, Ra-226
- Total radioactivity in cell: 940 Curies, Ra-226
- Cell dimensions: The above-ground disposal cell was constructed on gently sloping terrain and is roughly triangular in shape. It rises 44 feet (13 meters) above the surrounding terrain and is 2,200 feet (670 meters) long by 1,585 feet (480 meters) wide. A drainage ditch on the north and west sides of the cell directs runoff water away from the site.
- Cell design: The cell is capped by a 4.5- to 5-foot (1.4 to 1.5 meters)-thick, multi-layered cover. Contaminated materials were covered by a 3.5-foot (1 meter) radon/infiltration barrier of compacted clay. A 6-inch (0.15 meter) sand filter layer was placed on top of the radon barrier to promote drainage. The final erosion protection layer featured six inches (0.15 meters) of rock (Type A riprap) on the topslopes and 12 inches (0.3 meters) of rock (Type A and B riprap) on the sideslopes. The topslopes have a three to four percent slope to promote drainage; sideslopes were graded to 20 percent.

CONSTRUCTION STATISTICS

- Estimated risk reduction: 1.9 deaths prevented
- Peak employment level: 60
- Safety record:
  - Total Recordable Rate - 10.0
  - Total Lost Workday Rate - 5.0

- Remediation subcontractor: Crystal Creek Construction and Blue Eyes Fencing
- Contaminated material:
  - Equipment and method: Scraper
  - Haul distance: 500 to 5,000 feet (150 to 1500 meters)
- Cover material:
  - Radon barrier
    - Source: Greasewood Lake Borrow area
    - Type material: Clay
    - Haul distance: 1 mile (1.6 kilometers)
    - Equipment and method: Scraper
    - Quantity: 250,043 cubic yards (191,311 cubic meters)
    - Bentonite %: None
  - Frost barrier: None
- Erosion protection:
  - Bedding
    - Source: Shadow Mtn. Borrow area and Arrow Pit
    - Type material: Crushed basalt and natural sand blend

The mill site at Tuba City before remediation.



The mill site and disposal cell at Tuba City after DOE cleanup.

-- Haul distance: 23 miles (37 kilometers)
--Quantity: 47,953 cubic yards (36,689 cubic meters)
-- Gradation: 3 inches (7.6 centimeters) minus

- Type A
-- Source: Shadow Mtn. Borrow area
-- Type material: Crushed basalt
-- Haul distance: 23 miles (37 kilometers)
-- Quantity: 52,644 cubic yards (40,279 cubic meters)
-- Gradation: 3 inches (7.6 centimeters) minus

- Type B
-- Source: Shadow Mtn. Borrow area
-- Type material: Crushed basalt
-- Haul distance: 23 miles (37 kilometers)
-- Quantity: 12,768 cubic yards (9,769 cubic meters)
-- Gradation: 6 inches (15.2 centimeters) minus

- Type C
-- Source: Shadow Mtn. Borrow area
-- Type material: Crushed basalt
-- Haul distance: 23 miles (37 kilometers)
-- Quantity: 10,294 cubic yards (7,876 cubic meters)
-- Gradation: 10 inches (25.4 centimeters) minus

- Type D
-- Source: Shadow Mtn. Borrow area
-- Type material: Crushed basalt
-- Haul distance: 23 miles (37 kilometers)
-- Quantity: 7,352 cubic yards (5,625 cubic meters)
-- Gradation: 15 inches (38.1 centimeters) minus

- Type E
-- Source: Shadow Mtn. Borrow area
-- Type material: Crushed basalt
-- Haul distance: 23 miles (37 kilometers)
-- Quantity: 8,198 cubic yards (6,272 cubic meters)
-- Gradation: 20 inches (50.8 centimeters) minus

- Type F
-- Source: Shadow Mtn. Borrow area
-- Type material: Crushed basalt
-- Haul distance: 23 miles (37 kilometers)
-- Quantity: 13,500 cubic yards (10,329 cubic meters)
-- Gradation: 24 inches (61 centimeters) minus

OTHER INFORMATION

- Vicinity properties cleaned up: 1
- VP material handled: 560 cubic yards (428 cubic meters)
- Citizen advisory committee: None
- Public participation issues: Disputed ownership of land between the Hopi Tribe and Navajo Nations. A Federal Court awarded ownership of the property to the Navajo Nations.

MAJOR COST COMPONENT	Costs in $1,000's
Site Characterization	2,112
Env. Health & Safety/NEPA	1,015
RA Design	1,671
Site Acquisition	—
RA Field Management	2,470
Site Preparation	831
Tailings Handling	2,127
Cover Material	1,684
Erosion Protection	4,867
Site Restoration	1,567
All Other Construction Costs	4,102
VP Design	8
VP Construction	29
Surveillance & Maintenance	3,198
Site Specific Total	$25,681

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UMTRA Time Line of Events by Site

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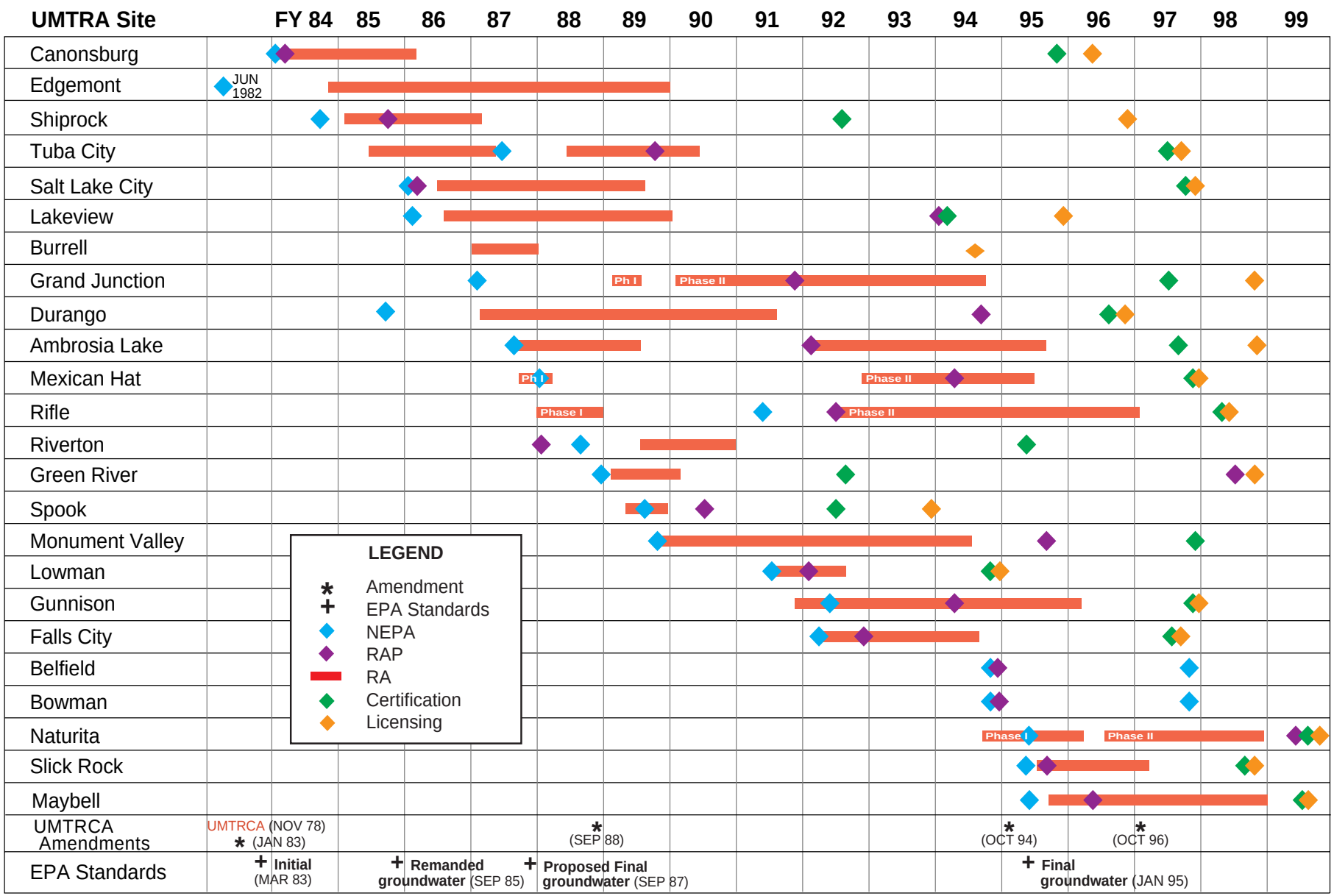

UMTRA Timeline of Events by Site

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Cost Summary

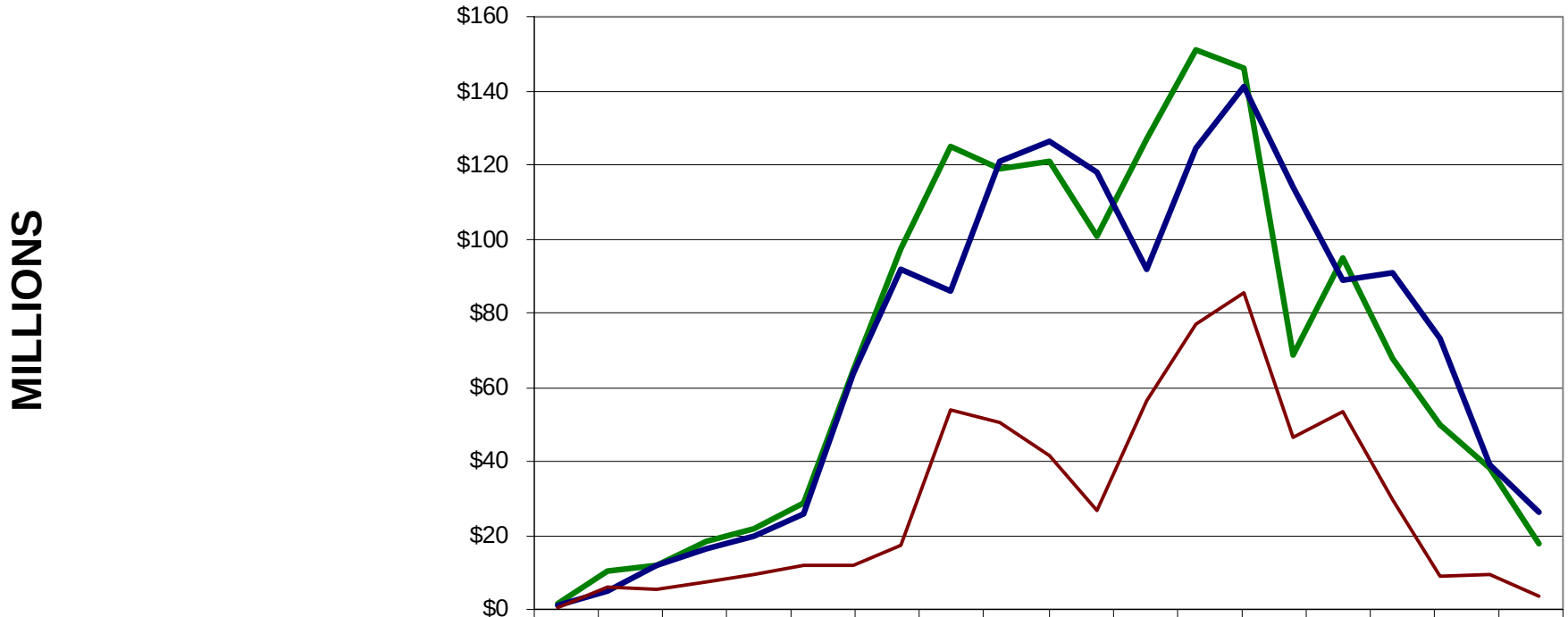
UMTRA Project Total Project Costs by Site and WBS

All values in Thousands ($K)

Site Name	Site Charact.	Env. Health/ Safety/NEPA	RA Design	Site Acquisition	RA Construction	RA Field Management
Ambrosia Lake, NM	1,706	1,009	3,178	422	19,212	8,091
Belfield/Bowman ND	1,527	1,498	992	-	-	-
Canonsburg, PA	2,682	888	962	4,833	8,809	3,521
Durango, CO	4,446	1,872	2,924	726	29,854	6,481
Edgemont, SD	213	6	-	-	-	716
Falls City, TX	4,267	1,068	2,516	500	26,133	6,894
Grand Junction, CO	30,215	3,419	5,400	1,065	114,208	42,420
Green River, UT	1,731	936	1,305	5	7,282	1,551
Gunnison, CO	7,051	1,718	5,441	277	15,924	8,620
Lakeview, OR	2,294	1,146	1,483	212	14,448	3,812
Lowman, ID	1,497	811	765	58	2,823	1,214
Maybell, CO	3,100	1,183	3,137	30	26,500	8,169
Mexican Hat, UT	1,751	1,033	2,892	-	24,626	11,934
Monument Valley, AZ	1,598	1,045	632	-	13,159	-
Naturita, CO	3,315	1,339	5,054	2,178	29,496	14,062
Rifle, CO	5,539	2,175	6,659	202	59,146	19,863
Riverton, WY	1,999	1,188	586	351	27,433	3,937
Salt Lake City, UT	2,812	1,867	661	509	57,045	1,667
Shiprock, NM	1,543	1,118	995	-	10,625	1,872
Slick Rock, CO	2,892	1,099	3,539	143	19,675	8,103
Spook, WY	1,210	831	710	35	1,281	814
Tuba City, AZ	2,112	1,015	1,671	-	15,178	2,470
TOTAL	85,500	28,264	51,502	11,546	522,857	156,211

Site Name	VP Design	VP Construction	Surveil. & Maint.	Site Specific Subtotal	Technology Development	Project Mgmt Alloc.	GRAND TOTAL
Ambrosia Lake, NM	36	15	118	33,787	790	5,384	39,961
Belfield/Bowman ND	1	-	1	4,019	1,580	4,640	10,239
Canonsburg, PA	3,748	8,372	1,186	35,001	496	12,094	47,591
Durango, CO	1,564	4,815	801	53,483	517	13,618	67,618
Edgemont, SD	818	3,165	-	4,918	364	129	5,411
Falls City, TX	42	34	133	41,587	790	13,877	56,254
Grand Junction, CO	54,912	198,804	56	450,499	1,398	52,151	504,048
Green River, UT	220	1,259	906	15,195	517	7,921	23,633
Gunnison, CO	135	639	542	40,347	861	17,709	58,917
Lakeview, OR	109	368	699	24,571	516	8,238	33,325
Lowman, ID	593	3,519	218	11,498	516	6,420	18,434
Maybell, CO	327	227	93	42,766	588	20,174	63,528
Mexican Hat, UT	151	1,408	195	43,990	770	9,722	54,482
Monument Valley, AZ	73	934	52	17,493	790	5,843	24,126
Naturita, CO	1,213	2,991	182	59,830	861	25,641	86,332
Rifle, CO	1,007	5,373	190	100,154	862	18,149	119,165
Riverton, WY	505	2,922	139	39,060	516	10,088	49,664
Salt Lake City, UT	3,982	15,129	275	83,947	936	9,282	94,165
Shiprock, NM	365	508	734	17,760	1,095	5,916	24,771
Slick Rock, CO	171	317	125	36,064	628	13,736	50,428
Spook, WY	45	459	113	5,498	516	4,092	10,106
Tuba City, AZ	8	29	3,198	25,681	517	7,945	34,143
TOTAL	70,025	251,287	9,956	1,187,148	16,424	272,768	1,476,340

UMTRA Project
Funding, Costs, and Carryover



	1979	1980	1982	1983	1984	1986	1987	1988	1990	1991	1992	1993	1995	1996	1997	1999
Total UMTRA Funding $1,480M Total	1.377	10.18	18.4	21.62	28.8	97.12	124.9	119.2	100.6	126.9	151.3	146.3	94.66	67.42	49.82	17.66
Costs (Budget Outlay) $1,476M Total	1.059	4.694	16.18	19.64	25.91	91.75	85.83	120.9	118.2	92.08	124.4	141.5	88.82	91.04	73.07	26.3
Federal Carryover (State Share Not Included)	0.319	5.781	7.486	9.224	11.62	17.23	53.6	50.4	26.44	56.51	77.2	85.67	53.26	29.5	9.122	3.342

Cost Summary Terms

The following activities are conducted at the Uranium Mill Tailings Remedial Action Project sites for each of the following work breakdown structure items:

- Site Characterization
  Review and analyze site information to describe and characterize each mill site and disposal site; install radon detectors for measuring radon concentrations, analyze data; prepare draft remedial action plan; review preliminary and final remedial action design documents; perform value engineering analysis; provide review support during construction; and prepare and review bid packages.

- Environmental Health/Safety/NEPA
  Oversight and compliance support to the Project's Environmental, Health and Safety (EH&S) Program; perform radiological and construction EH&S audits at mill sites, disposal sites, and disposal cells; prepare and conduct EH&S training; prepare draft Environmental Assessments and draft Environmental Impact Statements; identify alternate disposal sites and select preferred alternative for consideration by DOE; and administer Project's audit program including environmental, radiological, and quality assurance audits at mill sites and vicinity properties.

- Remedial Action (RA) Design
  Review of DOE furnished information and reports; evaluate design alternatives for cost effectiveness and adherence to EPA standards; prepare designs, specifications, estimates, schedules, reports, and studies for completion of the UMTRA Processing Site and Disposal Site Engineering requirements; review of DOE furnished reports (Environmental Impact Statements, Characterization Reports, Conceptual Designs, Design Criteria, and Remedial Action Plans); and preparation of the preliminary design, preliminary and final cost estimates and schedule, final design, bid packages, cost savings alternatives, final completion report, and as-built drawing and specifications.

- Site Acquisition
  Acquire the real estate interests relating to the project requirements involving a multitude of real estate actions and coordinate activities through a network of agencies.

- Remedial Action (RA) construction
  Activities related to a subcontractor performing removal of contaminated residual radioactive materials and disposal of these materials in an embankment with protective cover at the disposal site including: excavation, backfill, radon barrier production and placement, riprap production and placement, decontamination, demolition, concrete, masonry, finishing, carpentry, fencing, utilities, surveying, electrical, mechanical, and piping.

- Remedial Action (RA) Field Management
  Activities related to subcontractor monitoring and coordination, health physics, quality control, safety programs, and community relations as required including: construction management, health physics programming, quality control programming, safety programming, subcontractor coordination and monitoring, inspection, and quality statusing.

- Vicinity Property (VP) Design
  Review of DOE furnished information and reports; evaluation of design alternatives for cost effectiveness and adherence to EPA standards; and, preparation of designs, specifications, estimates, schedules, and completion reports, as required for completion of the UMTRA Vicinity Property Engineering requirements. Technical content: prepare Radiological and Engineering Assessment (REA); prepare final design for the remedial action; cost estimates and schedule; furnish property owner package; prepare Completion Report.

- Vicinity Property (VP) Construction
  Exterior and interior demolition, removal of contaminated materials, hauling of the material to the disposal site, decontamination of hauling vehicles, backfilling with clean material, restoration of pre-remedial action conditions, and any dewatering necessary as required to accomplish the remedial action associated with radiological contamination from residual radioactive material.

- Surveillance & Maintenance
  Prepare site-specific long-term surveillance plans; prepare final site ownership/custody documentation for completed sites; conduct an annual review and recommend revisions to site sampling requirements; and prepare permanent site file.

- Site Specific Subtotal
  Summary of site costs for Site Characterization; Environmental, Health, and Safety; Remedial Action (RA) Design; Site Acquisition; Remedial Action (RA) Construction; Remedial Action (RA) Field Management; Vicinity Property (VP) Design; Vicinity Property (VP) Construction; and Surveillance & Maintenance.

- Technology Development
  Five areas of technology were identified to explore facets of tailings disposal problems. These areas included cover technology, liner technology, measurements and monitoring, tailings conditioning, and basic studies.

- Project Management Allocation
  Performance measurement; integrated project management, planning and budgeting; information systems support; corporate support; programmatic public affairs; programmatic vicinity properties support; completed sites support; programmatic technical support; Remedial Action Contractor management; and Technical Assistance Contractor management.

- Grand Total
  Summary of Site Specific Subtotal, Technology Development, and Project Management Allocation.

Acronyms

BLM	Bureau of Land Management
CR/PIP	Cost Reduction/Productivity Improvement Program
DOE	U.S. Department of Energy
EA	environmental assessment
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ERD	Environmental Restoration Division, Albuquerque Operations Office
ERDA	Energy Research and Development Administration
FONSI	finding of no significant impact
NEPA	National Environmental Policy Act
NRC	U.S. Nuclear Regulatory Commission
pCi/g	picocuries per gram
RA	remedial action
Ra-226	Radium-226
RAC	Remedial Action Contractor
RAP	remedial action plan
ROD	record of decision
RRM	residual radioactive material
TAC	Technical Assistance Constractor
UMTRA	Uranium Mill Tailings Remedial Action
UMTRCA	Uranium Mill Tailings Radiation Control Act
VP	vicinity property

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Definitions

Cooperative Agreement: The U.S. Department of Energy entered into cooperative agreements with each of the ten states to perform remedial actions at each designated processing site in each state. The agreement released the United States of any liability or claim arising out of the performance of the remedial action. The agreement allowed the DOE, NRC, and EPA permanent rights of entry at any time to inspect the processing site. The agreement provided for reimbursement of the actual costs as determined by the DOE of any remedial action performed. The agreement also established document review schedules and conflict resolution procedure.

Disposal cell placement terms:

Stabilized in place: When the tailings pile is reshaped and the disposal cell is built on the pile.

Stabilized on site: When the tailings pile is relocated to another location on the processing/mill site and the disposal cell is built at this location.

Relocated: When the tailings pile is relocated to another location other then on the processing site and the disposal cell is built at that site.

EPA Standards (40 CFR 192) – Health and Environmental Protection Standards for Uranium Mill Tailings:

Subpart A — Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites. Contains design standards and compliance criteria for construction of disposal cells. Contains final groundwater standards and a table of "Maximum concentration of Constituents for Groundwater Protection. [48 FR 602, Jan. 5, 1983, as amended at 60 FR 2865, Jan. 11, 1995 and 60 FR 2866, Jan. 11, 1995]

Subpart B — Standards for Cleanup of Land and Buildings Contaminated with Residual Radioactive Materials from Inactive Uranium Processing Tailings. Sets concentration of radium-226 levels for remedial action for land and working and gamma radiation levels for occupied or habitable buildings resulting from contamination from residual radioactive materials from any designated processing site. [48 FR 602, Jan. 5, 1983, as amended at 60 FR 2866, Jan. 11, 1995 and 60 FR 2867, Jan. 11, 1995]

Subpart C — Implementation. Sets requirement for implementing agencies to establish methods and procedures to provide "reasonable assurance" that the provisions of Subparts A and B are satisfied. Establishes procedure for applying supplemental standards. [48 FR 602, Jan. 5, 1983, as amended at 60 FR 2867, Jan. 11, 1995 and 60 FR 2868, Jan. 11, 1995]

Residual radioactive materials (RRM): (1) waste that DOE determines to be radioactive in the form of tailings resulting from the processing of ores for the extraction of uranium and other valuable constituents of the ores; and (2) other waste, that DOE determines to be radioactive, at a processing site that relates to such processing, including any residual stock of unprocessed ores or low-grade materials.

Tailings: The remaining portion of a metal-bearing ore after some or all of such metal, such as uranium, has been extracted.

Total Recordable Rate: (Bureau of Labor Statictics, U.S. Department of Labor), Incident rate represented by the number of injuries and illnesses per 100 full-time workers and calculated as: (N/EH) x 20,000, where N = number of injuries and illnesses; EH = total hours worked by all employees during the calendar year; and 20,000 = base for 100 equivalent full time workers (working 40 hours per 50 weeks per year).

Total Lost Workday Rate: (Bureau of Labor Statictics, U.S. Department of Labor), Incident rate represented by the number of lost workdays per 100 full-time workers and calculated as: (N/EH) x 20,000, where N = number of lost workdays; EH = total hours worked by all employees during the calendar year; and, 20,000 = base for 100 equivalent full time workers (working 40 hours per 50 weeks per year).

Types A, B, C, and D rock: Terms used to define riprap rock size. Type A rock being the smallest rock used on a disposal cell (usually on the top of the cell where the slope is slight). Type B rock is larger than Type A rock and is used on side slopes where the grade of the slope is steeper that the top slope. Type C rock is larger than Type B rock and is typically used along the bottom edge of the side slope and in the drainage channels around the cell. Type D rock is the term for the largest size rock used for riprap protection of a cell.

UMTRCA Title I designated site: A former uranium ore processing site, including the mill, containing residual radioactive materials (RRM) at which all or substantially all of the uranium was produced for sale to any Federal agency prior to January 1, 1971 under contract with any federal agency, except in the case of a site at or near Slick Rock, Colorado, unless such site was owned or controlled as of January 1, 1978, or is thereafter owned or controlled by any federal agency. (In other words, a Title I site is an inactive, former, or abandoned mill site.)

UMTRCA Title II designated site: The ownership and custody of certain byproduct material and disposal sites is determined by the site having any license issued or renewed after the effective date of this section of UMTRCA (November 8, 1978) for any activity which results in the production of any byproduct material, as defined in section 11e(2). (In other words, a Title II site was an active site that had a license to produce 11e(2) material.)

> **Byproduct material (Sec. 201, Section 11e. of the Atomic Energy Act of 1954, as amended)**: This term means (1) any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear, and (2) the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content.

Vicinity property: Those properties, either public or private in the vicinity of the UMTRA Project inactive mill sites, that are believed to be contaminated by residual radioactive material, and may have been designated under Section 102(a)(1) of the Uranium Mill Tailings Radiation Control Act of 1978 (PL95-604).

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The following U. S. Department of Energy, Uranium Mill Tailings Remedial Action (UMTRA) Project documents may be ordered from the U.S. Department of Commerce and the National Technical Information Service. The Service will require the document name, number and date, and will charge for the cost of copying the documents requested. Call or write:

National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

"Groundwater Standards for Remedial Actions at Inactive Uranium Processing Sites," EPA 40 CFR Part 192, *Federal Register*, January 11, 1995.

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Uranium Mill Tailings Remedial Action Project Surface Project Management Plan, DOE/AL-62350-152, Rev. 1, December 1994.

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Guidance for Implementing the UMTRA Project Long-Term Surveillance Program (Final), UMTRA-DOE/AL 350125.0000, Rev. 1, September 1992.

Technical Approach Document, Revision II, UMTRA-DOE/AL 050425.0002, December 1989.

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Guidance for UMTRA Project Surveillance and Maintenance, UMTRA-DOE/AL-350124.0000, January 1986.

APPENDIX A

TYPICAL PERMITS USED ON THE UMTRA PROJECT

Access Agreement
Asbestos Removal (State)
Berm Replacement Approval
Conditional Use permit
Construction Permit
County Highway Access Permit
County Road Closure
Dam Permit
Dredge and Fill Permit (404 permit) (Corps of Engineers)
Easement/Lease Resolution (DOE)
Free Use Permits (Borrow Material)
Highway Crossing Agreement
Land Use Change (State, County, and Federal)
Land Use Permit/Certification of Designation
Mineral Materials Permit (US Forest Service)
Mining and Reclamation Permit
Mining and Reclamation Plan
Revocable Use Permit (Bureau of Indian Affairs)
Right-of-Way (Bureau of Land Management)
Right-of-Way Haul Road
Road Access/Highway Use
Special Use Borrow Permit
Special Use Permit
State Highway Access Permit
State Highway Utility Permits
Temporary Use Permit
Test Embankment Approval
Utility Permit
Surface Water Storage
Certificate of Designation Solid Waste Disposal (State)
Ground Water Discharge Notice and Plan (State)
Hazardous Water Storage
National Pollution Discharge & Elimination System (EPA)
State Pollution Discharge Permits
Wastewater Discharge (State)
Wastewater Discharge Permit
Ground Water Appropriation (State)
Construct Temporary Retention Basin
Temporary Water Permit
Construction Dewatering
County Floodplain Plan
Diversion and Storage of Surface Water (State)
Floodplain Permit Repository
Stormwater Discharge Permit
Surface Water Rights
Temporary Water Diversion (State)
Water Rights/Appropriation
Contract for Water Service (Bureau of Reclamation)
Ground Water Rights
Groundwater Discharge Permit
Notice of Intent-Excavation Dewatering
Well Abandonment Notice
Well Construction Permits
Well Sealing Notification
Air Emission Notices (State)
Air Emission Permit
Air Quality Construction Permit (State)
Cultural Restoration (State Historical Preservation Office)
Scientific Collection Permit
Threatened and Endangered Species Consultation (US Fish & Wildlife Service)
Wildlife Mitigation Plan (State)

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